Department of Science and Agriculture

BARBADOS.

AGRICULTURAL JOURNAL

Vol. 2 Nos. 1 & 2. April, 1933.

ADVOCATE CO., LTD.,—Printers & Bookbinders to the Government of Barbados.

FOREWORD.

The present issue of the Agricultural Journal comprises Parts 1 and 2 of volume 2.

For reasons of economy, a paper by Dr. A. E. S. McIntosh, B.Sc., Ph.D., Geneticist, entitled "Sugar Cane Growth Measurements in Barbados" has not been included. A limited number of copies of this paper will be shortly available for which application should be made to the Department.

This number of the Journal includes the concluding chapters of Professor Hardy's work on the Flora of Barbados. As such great interest has been evinced in this very complete natural history of the island it is hoped that it may shortly be published in book form.

Digitized by the Internet Archive
in 2025

https://archive.org/details/agricultural-journal_1933-04_2_1-2

CONTENTS. Page.

Report on the Work of the Department of Science and Agriculture for the year ending June 30th, 1933 .. .. 1—44

Some Aspects of the Flora of Barbados (concluded) by F. Hardy, M.A., Dip. Agric. .. .. 45—76

DEPARTMENT OF SCIENCE AND AGRICULTURE.

SECTION I.—STAFF.

Director of Science and Agriculture	R. W. R. Miller, B.A., (Camb.) A.I.C., Dip. Agric. (Cantab.)
Assistant Director	C. C. Skeete, B. A., (Cantab).
Geneticist	A. E. S. McIntosh, B.Sc., Ph.D., (Edin.)
Agricultural Chemist	S. J. Saint, M.Sc., Ph.D., F.I.C., (London).
Assistant to Professor of Chemistry	T. A. E. Barker, B.Sc., (London).
Lecturer in Natural and Agricultural Sciences	W. A. McD. Paterson, B.Sc.
Entomologist	R. W. E. Tucker, M.A., (Cantab)., B.Ed., (Capetown).
Veterinary Officer	C. P. Stoute, M.D.V., (Acting).
Chief Analytical Assistant	C. A. Coppin, B.A. Sc. (Toronto), A.I.C.
Plant Diseases Inspector	D. R. D. Wiles, D.I.C.T.A.
Chief Clerk	H. O. Ramsey.
Second Clerk	G. D. Ramsey.
Third Clerk	C. G. Humphrey.
Fourth Clerk	A. S. Inniss.
First Field Assistant	C. B. Foster.
Second Field Assistant	H. E. Ward.
Third Field Assistant	C. C. Corbin.
Fourth Field Assistant	F. E. Bynoe.
Analytical Assistant	H. A. Jones.
„ „	C. St. A. Alleyne.
„ „	L. A. Hall.
Botanical Assistant	L. H. Atkinson.
Foreman in charge of Nurseries ..	S. A. Eastmond.

Dr. McIntosh was absent on duty leave in Trinidad from February 15th to March 2nd.

Mr. C. C. Corbin was absent on vacation leave from January 16th to February 14th, 1933.

BRITISH WEST INDIAN SUGAR CANE BREEDING STATION.

Director	R. W. R. Miller, B.A., (Camb.) A.I.C., Dip. Agric. (Cantab.)
Members of Advisory Committee ..	G. Evans, M.A., C.I.E., Principal of Imperial College of Tropical Agriculture, Trinidad.
" " " ..	Hon. E. J. Wortley, O.B.E., F.C.S., F.L.S., Director of Agriculture, Trinidad.
" " " ..	Professor H. A. Ballou, M.Sc., Commissioner of Agriculture for the Windward and Leeward Islands.
Geneticist	A. E. S. McIntosh, B.Sc., Ph.D., (Edin.)
Assistant Botanist	G. C. Stevenson, B.A.
Field Assistant	J. M. Cave, D.I.C.T.A.
Statistical Clerk	H. L. Manning, D.I.C.T.A.

SECTION II.—BOARD OF AGRICULTURE.

The members of the Board of Agriculture, appointed for the Legislative Session, 1932-33, were as follows:—

The Honourable S. C. Thorne, M.L.C., Chairman.
(The late) Honourable Dr. W. B. H. Massiah, M.A., M.D., C.M., M.L.C.
G. D. L. Pile, Esq., B.A., M.C.P.
G. C. Mahon, Esq., M.C.P.
J. D. Chandler, Esq., M.C.P.
Henry Alleyne, Esq., M.C.P.
H. A. Arthur, Esq., M.C.P.
E. S. Robinson, Esq.

The Director of Agriculture is an *ex officio* member of the Board.

Mr. H. W. Reece, K.C., M.C.P., was appointed in place of Hon. Dr. W. B. H. Massiah, whose death took place during the year.

SECTION III—EXPENDITURE AND REVENUE.

EXPENDITURE.

Personal Emoluments	8,897	7	10
Travelling Allowances	1,046	11	9
Exhibition Expenses	142	16	2
Appointment Expenses of Scientific Officers	18	14	5
Expenses in Control of Sugar Cane Mosaic Disease	1,561	8	2
Expenses in Control of Pink Bollworm of Cotton (Salaries of Sub-Inspectors of Plant Diseases)	192	12	3
Experiment Stations and Botanic Station	2,190	5	5
Chemical Laboratory	833	19	10
Entomology	307	10	7
Sugar Polarization Laboratory	760	11	5
Unforeseen Contingencies	15	18	11
Sundries	347	19	7
Expenses in connection with duties of Veterinary Officer	5	15	5
Fumigatorium	19	17	8
Seed Distribution	65	12	0
	16,407	1	5

REVENUE.

Sale of Ornamental Plants	14	15	8
Sale of Produce from land leased by Department	47	4	3½
Sale of Cane Plants under Mosaic Disease Eradication Act	93	9	9
Fees for Analysis of Sugar and Molasses	1,555	2	0
Fees for Analysis of miscellaneous samples	95	14	6
Fees for Fumigation of Schooners, etc.	10	14	4½
Miscellaneous Receipts	88	8	9
	£1,905	9	4

SECTION IV.—PLANT INTRODUCTION AND DISTRIBUTION.

The importation of seeds of various ornamental flowering trees and shrubs was continued during the year.

The distribution of plants during the year was as follows:—

(a) Ornamental flowering trees	306
(b) Ornamental foliage trees	558
(c) Other ornamental plants	10
(d) Fruit trees	111
(e) Arbour Day free Distribution	4,299
(f) Palms	49
(g) Vegetable plants	136

SECTION V.—GENERAL.

NOTES ON THE SUGAR INDUSTRY.

The production of sugar from the crop reaped in 1932 broke all records and was made up as follows:—

	Long Tons of 2,240 lb.
Dark Crystals (96°)	74,681
Muscovado	4,457
Other Sugars	3,742
Fancy Molasses*	19,535
Total	102,415

*Equated at 330 gallons to the long ton.

TABLE I.

SUGAR PRODUCTION 1928—1933.

FIGURES OF PRODUCTION IN TONS OF 2,240 lb.

	1928.	1929.	1930	1931.	1932. Actual Production.	1933. Estimate.
Sugars Exported: Dark Crystals and others	62,659	65,517	50,445		82,880	91,333
Locally consumed* ..	5,500	5,500	5,500	5,500		
Fancy Molasses† (manufactured)	18,786	19,328	27,768	..	19,535	18,667
Total ..	86,945	90,345	83,713	..	102,415	110,000

The reaping of a record crop is always a milestone in the life of any agricultural community and this is especially the case in a one-crop colony such as Barbados. To what causes can this increase of more than 17,000 tons over the previous best crop be attributed? The weather undoubtedly played its part, but a still greater production of sugar will be recorded for 1933 although certain parts of the island have experienced, during 1932, a far from adequate rainfall, and these increases may be ascribed mainly to the planting of improved varieties of cane, a better (and incidentally more economical) system of manuring and

*Estimated figure.
†Equated at 330 wine gallons to the ton.

the development of a rational system of pest control, especially with regard to the sugar cane moth borer (*Diatraea saccharalis*).

Record crops are only gathered in after record employment and although certain classes of the community (such as artisans and carpenters) may have suffered to a certain extent, it is safe to assume that a greater number of persons have been in regular employment during the past twelve months than ever before.

Apart from years of actual drought, or the incidence of other pests and diseases, the total annual production of sugar should in the future never fall below 95,000 tons.

The new sugar cane variety, B.726, has proved itself under favourable weather conditions to be a cane of exceptional value and one plantation in 1932 reaped an average of more than fifty tons per acre from over fifty acres—B.726 is a sugar cane which in addition possesses an extraordinarily good juice.

Another variety, B.2935, which has not yet reached the commercial stage shows great promise for the drier areas of the island, and in trials on a commercial scale it gave an appreciably higher weight than the Ba.11569 variety with approximately the same juice.

COTTON.

The Sea-Island cotton situation remains very obscure and this is especially unfortunate for Barbados as cotton is an ideal rotation crop for the sugar cane.

A conference of those interested in the production of Sea-Island cotton in the Windward and Leeward Islands and Barbados was held in April 1932. Among the more important findings of the Conference were:—

(a) That some system of grading should be adopted in each Island;

(b) That a standard bale should be adopted for all islands as soon as possible;

(c) That a West Indian Cotton Growers' Association should be formed to advance the interests of the industry;

(d) Restriction of acreage and output.

As a consequence a local Cotton Growers' Association has been formed as a branch of the Barbados Agricultural Society and the Director of Science and Agriculture was appointed *ipso facto* a member of the Association.

The acreage of cotton allocated to Barbados by the Conference for the 1932—33 cotton season was 700 acres but the actual planting was only 234 acres (21 acres of plantation and 213 acres of peasant cotton).

Despite a number of optimistic opinions as to the future of this industry the fact remains that there are still large accumulations of Sea-Island cotton on hand in England and moreover the advent of artificial silk has hit the industry a deadly blow. It would appear that the one hope for the industry is the development of a new use for Sea Island lint and until such time as a definite demand for such a fabric has been established great care should be exercised in planting lest the present surplus stocks may be increased.

GROUND CROPS.

The acreage under sweet potatoes and yams in Barbados has been considerably restricted during the last two years. Previously a steady export trade was being developed with British Guiana and the following exports are recorded:—

	£
1928	3,466
1929	4,545
1930	2,766
1931	2,755
1932	1,647

The shrinkage is the result of prohibitive duties which have been placed on this class of produce by the Government of British Guiana.

Barbados has been wont to rest its land from sugar by the production of ground provisions and Sea-Island cotton and with these crops denied him the planter is compelled to increase the acreage under sugar cane. Such a system of agriculture demands the exercise of the greatest care lest the land should lose its fertility or losses from pest and diseases should rapidly increase. In this respect, especial watchfulness should be exercised so that the root borer and the brown hardback do not increase both in the area and extent of their depredations.

PEASANT AGRICULTURE.

Last year the formation of a dozen District Agricultural Societies was recorded, but not more than two or three continue to function. This is due to two causes—inability to obtain an Agricultural Instructor and the apparent impossibility of securing efficient local secretaries.

Of a total arable acreage of 68,737 in Barbados, small holders occupy approximately 13,949 acres. While certain of these peasant proprietors cultivate their holdings in an efficient and profitable manner by far the greater proportion, from one cause or another, do not do so. The two crying needs are for agricultural education and financial assistance.

The Barbadian peasant has not proved himself wishful of pledging his credit co-operatively and of two such societies formed only one borrowed money for the cultivation of the members' land and the correct registration of their titles. Considerable difficulty has been experienced in recovering this loan and it is apparent that Mr. Stockdale's dictum that the credit society system may

not be the best means of enabling West Indian peasant farmers to develop their land is at any rate true where Barbados is concerned.

The fact remains however that means must be found for financing and educating peasant farmers, as otherwise, increasing areas of land will become derelict.

CO-OPERATIVE PRODUCE MARKETING ASSOCIATION.

Although the District Agricultural Societies which were originally designed as feeders to the Co-operative Produce Marketing Association have not developed as was anticipated the Association itself is gradually finding its feet. During the period under review it was found necessary to increase the commission charged for selling perishable produce from 20—25%. The monthly sales from August last are as follows:—

	$ c.
August	756.67
September	1053.07
October	1114.63
November	1034.91
December	1230.09
January	1158.53
February	1415.71
March	1461.93

If the Association does not succeed the producers and the members have only themselves to blame as the public have stood by them loyally. It would appear that at least fifteen hundred dollars' worth of the right class of vegetable can be sold every month and if the Association were in a position to start a delivery its sales could be increased to a very considerable extent. Thus far, however, except on very exceptional occasions the difficulty has been to get enough produce to sell rather than to find enough customers for the produce.

BRITISH WEST INDIAN SUGAR CANE BREEDING STATION.

As a result of the Agricultural Conference held in London in July 1931, Barbados was chosen as the centre for the British West Indian Sugar Cane Breeding Station

The Empire Marketing Board made a grant of £300 for capital and £2,000 for recurrent expenditure which was allocated as follows:—

I. *Personal Emoluments.*

	£
Assistant Botanist	450
Field Assistant	200
Statistical Clerk	200

II. *Other Charges—Recurrent.*

Seedling Trials etc	380
Travelling	500
Contingencies	270

III. *Other Charges—Capital.*

Scales (3)	60
Office Equipment including Adding Machine	150
Irrigation Gutters	90
Total	£2,300

Mr. G. C. Stevenson was appointed Assistant Botanist and Messrs. J. M. Cave and H. L. Manning as Field Assistant and Statistical Clerk. Work started on December 1st, 1932, and the number of seedlings potted was increased from 14,000 to approximately 20,000.

Dr. A. E. S. McIntosh, Assistant Geneticist, paid visits to St. Kitts and to Trinidad to study the sugar cane requirements of those islands.

SECTION VI. ADMINISTRATIVE AND EXPERIMENTAL WORK.

(a) ADMINISTRATIVE.

CONTROL OF PESTS AND DISEASES.

By

D. R. D. WILES, D.I.C.T.A.

Plant Diseases Inspector.

MOSAIC DISEASE OF THE SUGAR CANE.

As part of the control measures of sugar cane mosaic disease, a Corn Close Season, extending from the 16th December, 1932, to the 31st March, 1933, was again enforced in the same areas as in previous years.

Also, as in recent years, cane plants free from mosaic infection were supplied to owners and occupiers in the proclaimed infected areas (vide Annual Reports 1927-28, 1928-29 and Ag. Jour. Vol. 1, No. 2. 1932). Plants were distributed, under the supervision of an Inspector, from the undermentioned centres:—

Parish.	Centre.	Variety.
St. Michael	Waterford Pln.	B. 891 & B. 726.
St. James and St. Thomas	Ridgeway „	B. 891 & B. 726.
St. George	Groves „	B.H. 10(12) & B. 726.
St. John	Lemon Arbor „	B.H. 10(12).

Applications were received from several occupiers in the proclaimed infected areas for plot inspections by an officer of the Department so that they may be able to take plant cuttings from their own plots. Only one occupier was refused permission.

Applications were also received from several plantations outside the proclaimed infected areas for cane inspection at the time of plant cutting. It is hoped that greater use will be made of this service in the future.

REPORTS ON INDIVIDUAL PARISHES.

Parish of St. Michael.

The extent of mosaic infection in this parish has remained fairly low in the tenantries, with the exception of the Ivy. A marked improvement has been noted in Goodland tenantry. Heavy infection, however, was located on

certain estates, namely, Warrens and Lears. This was due, no doubt, to improper selection of the plants at planting time.

The formerly heavily infected tenantries of Bank Hall, Bush Hall, Bay Estate, Cave Hill and Lodge Hill have remained fairly free from infection during the year, and many occupiers were allowed to take plants from their own plots after inspection by an officer of the Department.

Parish of Christ Church.

The areas in this parish which had previously been included in the list of proclaimed infected areas were released during the year, and owners and occupiers were allowed to cut their own plants.

Mosaic disease infection was found during the year scattered throughout the parish in small patches and not confined to any one area. The heaviest infection was found in the districts known as Below Rock, Hopewell tenantry, Chancery Lane tenantry, Enterprise tenantry and Pegwell tenantry.

Parish of St. John.

Mosaic disease infection in the proclaimed infected areas has diminished considerably as will be observed from the figures in the subjoined table. The tenantries in these areas were again supplied with healthy cane plants from Lemon Arbor. Arrangements were also made to have an Inspector at Wakefield Plantation whenever plants were being cut. Heavy infection was observed at Newcastle Plantation and Venture tenantry.

Parish of St. Joseph.

Only a small acreage in this parish was inspected owing to the inadequate staff at the disposal of the Department. Inspections were confined to those areas where the disease was previously known to exist. Infection was only found in Clevers Hill tenantry.

Parish of St. Lucy.

Mosaic disease infection in this parish was only found in ratoons at one estate and in Rock Hall Village. It is hoped that in the near future the services of only one Inspector will be required in the parishes of St. Lucy and St. Peter.

Parish of St. Peter.

Only ten diseased holes were found in this parish for the period under review. No infected holes were found in the area which had been in the list of proclaimed infected areas from 1927 to 1932. Owners and occupiers were allowed to obtain their plants from their own plots after inspection by an officer of the Department.

Parish of St. James.

Mosaic disease infection in this parish has remained fairly constant, being confined principally to the tenantries. Infection in the proclaimed infected

areas has diminished considerably owing to rogueing of diseased holes and the supply of healthy planting material. A slight increase in infection has been observed in one of the tenantries outside the infected area, namely, Greenwich Village.

Parish of St. Thomas.

Healthy cane plants were again supplied to Rock Hall Village. Very few diseased stools were discovered during the year. Inspections were extended in this parish during the year and new areas of infection were located. Infected stools were removed and it is hoped that next year the infection will be considerably reduced.

Parish of St. George.

The supply of healthy cane plants to infected areas was continued by the Department. Infection in the proclaimed infected areas has been considerably reduced (i.e. in Newbury tenantry, Market Hill tenantry and Sweet Bottom tenantry). Unfortunately, however, as in the parish of St. Thomas, mosaic disease infection has been found on certain estates which were entirely free on previous inspections. It is expected that by constant rogueing of diseased stools the infection will be considerably reduced.

All infected stools found during the year were destroyed to the satisfaction of departmental inspectors. The co-operation of owners and occupiers in this work has been of great assistance.

The following measures are employed by the Department for the control of the mosaic disease:—

(1) The constant inspection and rogueing of diseased stools from cane fields;

(2) The selection of healthy canes from which plants are to be obtained. Too much stress cannot be laid on this point because it is on this selection that the amount of infection found will depend. The Department will endeavour to make arrangements for the inspection of plots from which it is desired to cut plants, provided reasonable notice is given;

(3) The delimitation of certain infected areas by proclamation, in which areas no one is allowed to obtain plants from his own plot except it has been previously inspected by an officer of the Department of Agriculture and declared free from mosaic disease;

(4) The enforcement of a Corn Close Season for a certain period during the year in the proclaimed infected areas. The object of a Corn Close Season is to remove the host plant of the insect vector of the mosaic disease, *Aphis maidis*, and thereby reduce the number of these undesirable insects.

COMPARATIVE TABLE SHOWING THE ACREAGES INSPECTED AND MOSAIC DISEASE INFECTION FOR THE YEARS 1929, 1930, 1931 AND 1932.

Parish.	1929.		1930.		1931.		1932.	
	Acreage Inspected.	Number of Infected Holes.	Acreage Inspected.	Number of Infected Holes.	Acreage Inspected.	Number of Infected Holes.	Acreage Inspected.	Number of Infected Holes.
St. Michael ..	3,821	5,221	5,336¾	5,867	2,995½	2,748	2,979½	3,561
Christ Church	3,398¼	452	3,790¼	264	4,001¼	294	4,062	646
St. Philip ..	2,173¾	3	771¾	..	..	..	..	..
St. Lucy ..	692	56	1,922½	162	2,170¼	99	2,435¾	107
St. Peter ..	2,568¼	782	2,676½	81	2,159	13	2,581	10
St. James ..	960½	846	1,275½	1,267	1,644	563	1,850	550
St. Thomas ..	905¼	1,626	1,755	692	1,449¾	2,260	1,498	4,087
St. Joseph ..	383	111	179¼	231	254¼	284	170¾	48
St. George ..	433½	1,559	1,178¾	2,759	2,806½	3,481	2,608¾	3,626
St. John ..	7		1,060¾	2,304	1,734¼	10,024	2,074¼	2,145
St. Andrew ..	..	..	..	..	..	..	..	..
Total ..	15,333½	10,656	19,946¾	13,627	19,214¾	19,766	20,258	14,780

GUMMING DISEASE OF THE SUGAR CANE.

The leaf symptoms of gumming disease of sugar cane which were first observed in Barbados in 1929 continue to make their appearance throughout the island, especially where the variety Ba.11569 is planted.

During the year under review, symptoms of this disease were observed in January in the variety Ba.11569 in the young crop which had been planted in November 1932.

Up to the present, no factories have reported any difficulty in the manufacture of sugar from canes affected by the disease.

INSPECTIONS UNDER THE COTTON DISEASES PREVENTION ACT 1928.

Inspection of the cotton plots for the presence of the Pink Bollworm of cotton (*Pectinophora gossypiella* Saund) was begun as soon as the trees began to boll. The first pink bollworm was observed on 3rd January 1933. The pest has been observed in all the cotton-growing areas but the damage has been very slight.

The normal routine of the cleaning up of old cotton fields and destroying the trees and refuse by fire was carried out during April 1932.

The Peasant Cotton Plot Competition was held again this year in conjunction with the Peasants' Agricultural Exhibition. It is gratifying to record that the object of this competition has been fully realized, in that almost all cotton growers adopted the method of planting recommended by this Department.

For the period under review, 7,086 bags of imported cotton seed were disinfected in the Simon's Heater under the supervision of an Inspector, and the holds of fifteen ships were fumigated with Zyklon B.

During the year a new Plant Pests and Diseases (Importation) Act was placed on the Statute Book. The object of this act is to control the importation of seeds, plants and planting material so as to ensure that only healthy material is introduced.

MISCELLANEOUS INSPECTIONS.

For the period under review, the following privately imported planting material was examined:—

344 Packages of Bulbs, Rose trees, Vegetable and Flower Garden Seeds	Examined and passed
5 Cases Carnation Plants	,, ,, ,,
2 ,, Orchids	,, ,, ,,
2 Packages Rose Trees	,, ,, ,,
5 ,, Lily Bulbs	,, ,, ,,
3 Bags Pineapple Suckers	,, ,, ,,
6 Orchids	,, ,, ,,
1 Case Coconut Plants	,, ,, ,,
106 Coconut Plants	,, ,, ,,
298 Citrus Plants	Roots washed and all soil removed.
20 Mango Plants	,, ,, ,,
2 Ferns	,, ,, ,,
25 Breadfruit Plants	,, ,, ,,
23 Palms	,, ,, ,,
41 Miscellaneous Plants	,, ,, ,,
1 Package Seed	Fumigated
26 Coconut Plants	Destroyed
1 Plant	,,
1 Citrus Plant	,,
1 Package Banana Suckers	,,

VETERINARY SERVICE.

The activities of the Veterinary Service during the year were directed mainly against the introduction of diseases in the Island by examination, at the Port, of all animals from the neighbouring Colonies and other countries; medical and surgical treatment of animals belonging to the various Government Institutions and the inspection of live stock and meat at the Bridgetown Abattoir.

During the period under review 16,246 animals were killed and inspected. viz:

Cattle	2087
Calves	1213
Sheep	3125
Goats	397
Pigs	9424
Total	16246

The animals condemned as unfit for human consumption were as under:—

Disease	*Bulls*	*Cows*	*Oxen*	*Pigs*	*Sheep*	*Total*
Tuberculosis	2	13	42			57
Abscesses, etc.		1	1	1	1	4
Total	2	14	43	1	1	61

The Dairy Regulations were brought into force during the year and will be useful for collecting data in respect of the animals kept for the supply of milk and in furnishing information regarding the methods of operation in dairies.

A Bill—The Diseases of Animals Act—in the draft was submitted and will, it is hoped, be dealt with by the Legislature, at an early date.

The Acting Veterinary Officer was from the 1st of September, 1932, appointed to act as Supervisor of the Public Market, in conjunction with his other duties.

(b) EXPERIMENTAL.

SUGAR CANE SPACING EXPERIMENTS.

In the Annual Report of this Department 1930-31, page 41, an account of a preliminary sugar cane spacing experiment, conducted at Codrington Experimental Station, was given.

During the two seasons since the preliminary experiment, further and more extensive experiments, one at a high rainfall station, Mount Wilton, and one a medium-low rainfall station, Alleynedale, were conducted with a similar object.

The experiments laid down in November-December 1930 were reaped as plant canes in 1932 and as first ratoons in 1933. The experiments laid down in 1931, in repetition of the former, were reaped as plant canes in 1933. The results therefore of six experiments appear in the following tables.

In the cane hole system practised in Barbados, four spacings were tried, viz. (A) 6 x 6 feet, (B) 5 x 5 feet, (C) 5 x 2½ feet, and (D) a spacing which may best be described as "continuous planting", effected by placing cuttings or pieces of cane of convenient length end to end in drains or furrows 5 feet apart.

Three varieties were planted in each spacing at each station, viz:

Mount Wilton	B.891, B.H. 10(12), B.726.
Alleynedale	B.891, Ba. 11569, B.726.

These varieties were selected from among those recommended for commercial planting as representing as nearly as possible the three growth types, erect, intermediate and recumbent.

The experiments were laid out in four randomised blocks at each station, the plot size being 900 square feet, or 6 x 6, that is 36 cane holes of 5 x 5 feet spacing, being 1-48th of an acre.

In the following Tables

A represents 6 x 6 feet spacing
B „ 5 x 5 „ „
C „ 5 x 2½ „ „
D „ 5 x continuous planting.

EXPERIMENT I.

MOUNT WILTON. PLANT CANES 1930-32.

The standard spacing of the area represented by this station is 5 x 5 feet, spacing B.

In Tables I—III the mean yield in tons per acre of 4 plots is presented in the first column, and the increase or decrease in yield of spacings A, C and D, as compared with spacing B is presented in the second column for each variety respectively.

In the following Table a difference between mean yields of 4.50 tons per acre has a 20 to 1 chance of being a real difference due to spacing and can be considered as significant with a fair degree of confidence.

TABLE I.

Spacing.	B. 891.		B.H. 10(12).		B. 726.	
	Yield.	Difference from B.	Yield.	Difference from B.	Yield.	Difference from B.
A ..	30.97	— 1.52	30.00	— 8.04	37.84	— 0.56
B ..	32.49	..	38.04	..	38.40	..
C ..	36.89	+ 4.40	40.78	+ 2.74	46.31	+ 7.91
D ..	35.34	+ 2.85	41.43	+ 3.39	45.14	+ 6.74

Under the soil and climatic conditions of this experiment, the yield obtained from spacings C and D in the case of the variety B.726 are significantly greater than that of the standard spacing B, and this greater yield may safely be attributed to the effect of the closer spacing.

EXPERIMENT II.

MOUNT WILTON. FIRST RATOONS. 1931-33.

In the following Table a difference between mean yields of 5.74 tons per

acre has a 20 to 1 chance of being a real difference due to spacing and can be considered as significant with a fair degree of confidence.

TABLE II.

Spacing.	B. 891.		B.H. 10(12).		B. 726.	
	Yield.	Difference from B.	Yield.	Difference from B.	Yield.	Difference from B.
A ..	31.04	— 0.26	33.99	— 2.07	35.49	+ 0.09
B ..	31.30	..	36.06	..	35.40	..
C ..	32.59	+ 1.29	34.35	— 1.71	41.53	+ 5.95
D ..	30.78	— 0.52	36.34	+ 0.28	40.16	+ 4.58

Under the soil and climatic conditions of this experiment, the yield obtained from spacing C in the case of the variety B.726 is significantly greater than that of the standard spacing B, whereas the greater yield from spacing D cannot be regarded with safety as being entirely due to the effect of spacing.

EXPERIMENT III.

MOUNT WILTON. PLANT CANES. 1931-33.

In the following Table a difference between mean yields of 5.40 tons per acre has a 20 to 1 chance of being a real difference due to spacing and can be considered as significant with a fair degree of confidence.

TABLE III.

Spacing.	B. 891.		B.H. 10(12).		B. 726.	
	Yield.	Difference from B.	Yield.	Difference from B.	Yield.	Difference from B.
A ..	36.68	— 5.43	45.49	— 7.08	43.91	— 4.39
B ..	42.11	..	52.57	..	48.30	..
C ..	48.86	+ 6.75	55.79	+ 3.18	50.25	+ 1.95
D ..	44.53	+ 2.44	48.36	— 4.21	48.41	+ 0.11

Under the soil and climatic conditions of this experiment, the yield obtained from spacing C in the case of the variety B.891 is significantly greater than that of the standard spacing B. There is also a fair probability that the same applies in the case of the variety B.H.10(12).

EXPERIMENT IV.

ALLEYNEDALE. PLANT CANES. 1930-32.

The standard spacing of the area represented by this station is 6 x 6 feet, spacing A, or a spacing intermediate between spacing A and spacing B.

In Tables IV-VI the mean yield in tons per acre of 4 plots is presented in the first column, and the increase or decrease in yield of the spacings B, C and D compared with spacing A is presented in the second column for each variety respectively.

In the following Table, a difference between mean yields of 4.28 tons per acre has a 20 to 1 chance of being a real difference due to spacing and can be regarded as significant with a fair degree of confidence.

TABLE IV.

Spacing.	B. 891.		Ba.11569		B. 726.	
	Yield.	Difference from A.	Yield.	Difference from A.	Yield.	Difference from A.
A ..	32.14	..	35.51	..	32.59	..
B ..	37.82	+ 5.68	38.94	+ 3.43	40.24	+ 7.65
C ..	36.35	+ 4.21	42.50	+ 7.00	38.84	+ 6.24
D ..	39.35	+ 7.21	39.50	+ 4.00	36.63	+ 4.04

Under the soil and climatic conditions of this experiment, the yields obtained from spacings B, C and D in the variety B.891, from spacing C in the variety Ba 11569 and from spacings B and C in the variety B.726 are significantly greater than those of the respective yields of spacing A; and this greater yield may safely be attributed to the effect of the closer spacing.

EXPERIMENT V.

ALLEYNEDALE. FIRST RATOONS. 1931—33.

In the following Table a difference between mean yields of 3.44 tons per acre has a 20 to 1 chance of being a real difference due to spacing and can be regarded as significant with a fair degree of confidence.

TABLE V.

Spacing.	B. 891.		Ba. 11569		B. 726.	
	Yield.	Difference from A.	Yield.	Difference from A.	Yield.	Difference from A.
A ..	31.80	..	36.78	..	33.72	..
B ..	33.79	+ 1.99	39.65	+ 2.87	36.06	+ 2.34
C ..	32.10	+ 0.30	41.47	+ 4.69	36.20	+ 2.48
D ..	31.70	— 0.10	37.51	+ 0.73	36.19	+ 2.47

Under the soil and climatic conditions of this experiment, the yield obtained from spacing C in the variety Ba.11569 is significantly greater than that of the standard spacing A, and this greater yield may safely be attributed to the effect of the closer spacing.

EXPERIMENT VI.

ALLEYNEDALE. PLANT CANES. 1931—33.

In the following Table a difference between mean yields of 5.56 tons per acre has a 20 to 1 chance of being a real difference due to spacing and can be regarded as significant with a fair degree of confidence.

TABLE VI.

Spacing.	B. 891.		Ba. 11569		B .726.	
	Yield.	Difference from A.	Yield.	Difference from A.	Yield.	Difference from A.
A ..	38.90	..	33.31	..	38.80	..
B ..	40.85	+ 1.95	39.12	+ 5.81	40.24	+ 1.44
C ..	40.85	+ 1.95	39.02	+ 5.71	41.07	+ 2.27
D ..	40.69	+ 1.79	41.09	+ 7.78	40.88	+ 2.08

Under the soil and climatic conditions of this experiment, the yields obtained from spacings B, C and D in the variety Ba.11569 are significantly greater than that of the standard spacing A; and these greater yields may safely be attributed to the effect of the closer spacings.

SUMMARY.

The results of the spacing experiments carried out to date have been summed up in Tables I to VI where the differences in yield between the customary spacing and the experimental spacing are given.

MOUNT WILTON.

TABLE VII.

Spacing.	B. 891.			B.H. 10 (12).			B. 726.			Average Difference.
	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	
A	— 1.5	— 0.3	— 5.4	—8.0	— 2.0	— 7.1	— 0.5	+ 1.0	— 4.4	— 3.36
B	..	..	..	..	..	..	..	..	..	..
C	+ 4.4	+ 1.3	+ 6.8	+ 2.7	— 1.7	+ 3.2	+ 7.9	+ 6.0	+ 2.0	+ 3.6
D	+ 2.9	..	+ 2.4	+ 3.4	+ 0.3	— 4.3	+ 6.7	+ 4.6	+ 0.1	+ 1.8

ALLEYNEDALE.

TABLE VIII.

Spacing.	B. 891.			Ba.11569			B. 726.			Average Difference.
	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	Plant Canes 30-32.	Ratoons. 33.	Plant Canes 31-33.	
A	..	..	..	..	..	..	..	..	..	..
B	+ 5.7	+ 2.0	+ 2.0	+ 3.4	+ 2.9	+ 5.8	+ 7.7	+ 2.3	+ 1.4	+ 3.7
C	+ 4.2	+ 0.3	+ 2.0	+ 7.0	+ 4.7	+ 5.7	+ 6.2	+ 2.5	+ 2.3	+ 3.9
D	+ 7.2	— 0.1	+ 1.8	+ 4.0	+ 0.7	+ 7.8	+ 4.0	+ 2.5	+ 2.1	+ 3.3

Taking the average differences for the different spacings for all varieties and crops at each centre the following conclusions may be drawn:—

(1) At the high rainfall station, spacing C gives a higher yield than spacing B or A while spacing D is not better than C;

(2) At the medium-low rainfall station, spacing B is better than spacing A but spacing C and D cannot be said to be better than B;

(3) The adoption of spacing C instead of B at high rainfall station and spacing B instead of A at the medium-low rainfall centre should give an increased yield equivalent to about 3½ tons of cane per acre.

RECOMMENDATION.

The evidence so far obtained indicates that it would be a profitable undertaking to adopt a 5 x 2½ spacing at the red soil centres and a 5 x 5 spacing at the black soil centres.

YIELD TRIAL OF CERTAIN VARIETIES OF COWPEA *(VIGNA SP.)*

The object of this trial was to compare the yield of certain recently introduced varieties of cowpea with that of the two varieties commonly grown in Barbados, namely Rounceval and Barbados Black Eye.

The trial, conducted at Codrington Experimental Station, consisted of four randomized blocks of six plots (varieties) each. The plot size was 20 cane holes or 500 square feet. There were seven seed holes to each cane hole, and four to six seeds were placed in each seed hole.

The trial was sown on June 17th, 1932. It was supplied (i.e. blanks were resown) on three subsequent occasions owing to destruction of the young seedlings by birds. The area was not irrigated, but during the period of growth (June 17th to August 10th), approximately nine inches of rain fell.

The earliest maturing varieties began flowering on July 20th, and the earliest mature pods were harvested on August 11th.

The total yields in ounces of marketable pods of the four plots of each variety at each picking are shown in Table I.

TABLE I.

Variety.	11/8.	15/8.	18/8.	23/8.	30/8.	6/9.	16/9.	23/9.	29/9.	Total.
Dixie Queen	137¼	239¼	132½	144¾	48½	..	..	..	..	702¼
Rounceval	..	..	..	72½	105¾	93½	78	23¼	16	389
Barbados Black Eye ..	..	..	19½	145¼	242¾	94¼	45	23	23¼	573
Extra early Black Eye ..	97	191½	112¾	137½	39¾	..	..	..	..	578
Grey Crowder	..	..	..	50¼	190½	160½	100¾	21¼	26	549½
Ramshorn	..	232½	145½	138	60¼	24½	..	..	..	599¾

A statistical analysis of these yield results shows that a difference in total yield of sixty-one ounces has a 20:1 chance of being due to a difference in variety and may be regarded as being significant.

The results of the trial, as set forth in Table I, show:—

(1) that the variety Dixie Queen is a significantly greater yielder than the local varieties;

(2) that the local variety "Rounceval" is the lowest yielder;

(3) that the three varieties Dixie Queen, Ramshorn and Extra Early Black Eye yield their crop four weeks earlier than the local varieties.

Table II is included to show the yield in ounces of marketable shelled peas obtained from the marketable pods, and the computed yield per acre.

TABLE II.

Variety.	Total Weight of pods.	Total Weight of shelled peas.	Weight of shelled peas expressed as % pod weight.	Yield per acre of pods in pounds.
Dixie Queen	702¼	461	65.6	955.4
Rounceval	389	212	54.5	529.4
Barbados Black Eye	573	297	51.8	779.8
Extra Early Black Eye	578½	330	57.3	786.6
Grey Crowder ..	549½	327	59.5	747.2
Ramshorn	599¾	372	62.0	816.6

A statistical analysis of the yield results of shelled peas shows that a difference in yield of forty-five ounces has a 20:1 chance of being due to variety and may be regarded as being significant.

Conclusion. Under the conditions of the trial the variety Dixie Queen is greatly superior to the locally grown varieties. The fact that this variety also yields its crop four weeks earlier than the local varieties is of great importance for two reasons. The land is released for other purposes earlier, and the greater portion of the pods are harvested before the cowpea weevil (*Mylabris chinensis*) and the bean weevil (*Mylabris quadrimaculatus*) have had time to increase into sufficient numbers to cause serious damage. In the cultivation of the later maturing varieties a very considerable percentage of pods is damaged by these weevils.

SECTION VII.—CHEMICAL.

REPORT ON CHEMICAL SECTION

By

S. J. SAINT, M.Sc., Ph.D., F.I.C.

Agricultural Chemist.

I. **Analytical Work.**
- A. Food and Drugs Laboratory.
- B. Sugar Laboratory.
- C. Analysis of Seedling Canes.

II. **Investigational and Advisory Work.**
- A. Sugar Technology.
- B. Soils.
- C. Manuring.

I. ANALYTICAL WORK.

A. FOOD AND DRUGS LABORATORY.

The total number of samples examined for the various Government Departments and for private individuals during the year was 1275. This represents an increase of 119 samples over the previous year. There has been an annual increase in the number of samples received for analysis for the past five years as will be seen by reference to Table I.

TABLE I.

Year.	1928	1929	1930	1931	1932
No. of Samples	723	992	1007	1156	1275

Fuller particulars of the samples dealt with in 1932 are as follows:—

1. Police.

Viscera and examinations for poisons	12
Milks	270
Rums	36
Coins and counterfeit exhibits	32
Miscellaneous	67
	417

Viscera, etc.

From a sample of mixed urine and vomit, mercury equivalent to half a grain of mercuric chloride was separated. A wine glass submitted in connection with this viscera was found to contain traces of a white powder which was identified as mercuric chloride.

Four eggs which seemed to be perfectly normal in external appearance were found to smell of nitrobenzene on breaking. From the available evidence, the opinion was expressed that the egg contents had absorbed the nitrobenzene odour through the shell.

A sample of linseed cake meal was found to be contaminated with a petroleum oil.

From a sample of rum, one and a half ounces of sodium carbonate and about a quarter of an ounce of rubber solution were separated.

A sample of vomit which measured 8.5 cc. was found to contain 12.14 grains of nitrobenzene. In connection with the same case, examination of the urine and stomach contents failed to reveal the presence of nitrobenzene.

In four samples of food suspected to contain deleterious substances, no poisonous or harmful ingredients could be found.

Milks.

270 samples were received for examination and 45 or 16.7% were found to be adulterated.

34 samples were reported as containing added water and the other 11 samples which contained less than 3% fat, were deemed to have had fat removed.

Rums.

36 samples of rum were examined and 41.7% were found under the strength necessitated by law.

Coins and Counterfeit Exhibits.

22 counterfeit coins chiefly in the form of shillings or florins were received. All coins had been made in moulds and, in view of their low specific gravity and the appearance of the milling where the mould collar had been, it is difficult to understand how these coins can be passed as legal tender.

A coiner's outfit consisting of plaster of paris moulds bearing the imprint of threepenny, sixpenny, shilling and florin pieces, was received together with pieces of metal which were identified as tin, copper and solder.

Miscellaneous.

Samples of salt fish, salt pork, vinegar, rice, flour, water and bread were received for analysis and report under the Food and Drugs Act.

A number of samples of the vinegars submitted were found to contain less than 4% acetic acid and some of the samples were found to be diluted acetic acid.

2. **Customs.**

Petroleums	117
Condensed Milks, Creams and Milk Powders	13
Miscellaneous	7
	137

Petroleums.

All the samples of kerosene oil examined had flash points well within the limits prescribed by the Petroleum Act.

Gasolene samples were submitted for determinations of specific gravity, crude oil samples for Engler distillations and miscellaneous oil samples for an expression of opinion as to classification under the Customs Tariff Act.

Condensed Milks, etc.

The condensed milks, creams and milk powders received for analysis all proved to be of good quality.

Miscellaneous.

Various samples such as perfumes, stains, "Oil of Wine," "Colas" were submitted for analysis and an expression of opinion as to classification under the Customs Tariff Act.

3. **Agricultural Society.**

Feeding Stuffs	74
Fertilizers	34
Sugars and Molasses	220
	328

Feeding Stuffs and Fertilizers.

These samples were received from the official samplers of the Agricultural Society and are analysed under the Fertilizers and Feeding Stuffs Act. All the feeding stuffs examined were unadulterated and of good quality. With the exception of one or two mixed fertilizers in which soluble phosphates had

reverted to the insoluble condition, the analyses of all fertilizers submitted corresponded closely to their guaranteed analyses.

Sugars and Molasses.

These samples were analysed in connection with the prize awards of the Annual Industrial Exhibition. A detailed report of the results of the examination was submitted to the Agricultural Society.

4. **Waterworks.**

Waters	6
Fuel Oil	2
	8

Waters.

Analyses of water were carried out periodically during the year and the usual uniform high quality was maintained.

Fuel Oil.

Samples of fuel oil used at the various pumping stations were analysed to determine that the specified standard was maintained.

5. **Sanitary Inspectors.**

Salt Fish	6
Salt Pork	1
Canned Herrings	1
Cocoa Beans	1
Maize Meal	1
	10

Salt Fish.

Of the 6 samples examined, 3 were condemned as unfit for human food.

Salt Pork.

This sample was in an advanced state of decomposition and was condemned.

The samples of Cocoa Beans, Canned Herrings and Maize Meal were all satisfactory in quality.

6. **Other Government Departments.**

Department of Agriculture	4
Mental Hospital	3
Central Road Board	1
Government of St. Lucia	3
	11

The samples dealt with under this head consisted of feeding stuffs, waters and fuel oils.

7. Private Individuals.

The following analyses were carried out for private individuals:—

Cane Juices	200
Syrups and Molasses	64
Milks	28
Hydrometers for Calibration	24
Petroleum Oils	15
Fertilizers	11
Feeding Stuffs	2
Alcohols	6
Waters	4
Polariscopes for adjustment	2
Miscellaneous	8
	364

B. SUGAR LABORATORY.

All sugar, fancy and choice molasses sent to Bridgetown from the factories is sampled and the samples are analysed in this laboratory. This analysis serves as a basis in assessing the price paid by the buyer to the manufacturer.

Since this laboratory has been organised and run as a commercial undertaking by the Government, particulars of the number of samples, expenditure and revenue are given in Table II for the past four years.

TABLE II.

Year	Number of Samples		Exp'diture			Receipts			Profit		
	Sugar	Molasses	£	s	d	£	s	d	£	s	d
1929–30	29978	8114	868	0	0	1904	12	0	1036	12	0
1930–31	20181	9899	798	0	0	1504	0	0	706	0	0
1931–32	18141	9712	715	0	0	1392	13	0	677	13	0
1932–33	25916	8194	761	0	0	1705	10	0	944	10	0
					Total	..			£3,364	15	0

C. ANALYSIS OF SEEDLING CANES.

In connection with the genetical investigations of the Department, 3,727 samples of cane were milled in the Machinery Room. In every case, the expressed juice was analysed and, where the analysis of the whole cane was needed, analyses were also made of the megass.

II. INVESTIGATIONAL AND ADVISORY WORK.

A. SUGAR TECHNOLOGY.

A large number of advisory visits were made to Dark Crystal, Muscovado Sugar and Syrup factories during the year.

A scheme for the introduction of chemical control into eight of the smaller vacuum pan factories in the island was organised during the year and put into operation this crop season. It is working satisfactorily.

A total of 26 indicator sets for the colorimetric estimation of hydrogen ion concentration were made up and supplied to dark crystal, muscovado sugar and syrup factories as an aid in controlling the various manufacturing processes.

A small plant is in course of erection in the Machinery Room and it is intended to carry out experimental work on syrup manufacture. A boiler, filter press and an Aspinal pan were obtained in the island.

An investigation into the sucrose status of low purity massecuites under different but controlled conditions of cooling in the crystalliser was carried out at Bulkeley Factory. In connection with this investigation, a new and rapid method for determining the supersaturation of sucrose in solution was developed which can be readily adapted for use in a factory laboratory.

B. SOILS.

The sampling and analysis of soils have been continued in the out-of-crop season and advisory reports giving recommendations as to manuring have been issued.

In connection with the soil survey of the island, profile studies are being made at various selected sites. A detailed study of the profile samples which are collected is being made. Determinations of mechanical analyses, silica-alumina ratios of clay fractions and soils, total nitrogen, total carbon, calcium carbonate, total exchangeable bases and hydrogen ion concentration, have been made on about thirty samples selected from the red, black, intermediate red-black and red sand soils of the coral limestone area.

The investigation into the nitrogen status of an arable soil, without vegetation, was continued. Samples of soil were taken weekly and determinations were made of moisture and total, nitrate and ammonia nitrogen.

C. MANURING.

The manurial experiments carried out on sour grass and sugar cane during the year have given additional support to the results obtained in previous trials. On the basis of these results, definite recommendations as to the manuring of sour grass and sugar cane have been made.

SECTION VIII.—ENTOMOLOGICAL.

REPORT ON ENTOMOLOGICAL SECTION

BY

R. W. E. TUCKER, M.A., B.Ed.,
Entomologist.

SMALL MOTH BORER, *DIATRAEA SACCHARALIS.*

The principal feature of this year's report is the continued and increased success of the use of *Trichogramma minutum* as a controlling agent for *Diatraea saccharalis* in cane.

Another year of mass liberation of parasites, and another crop reaping and analysis are still necessary to place the control beyond dispute, but the results obtained so far are consistent, and the crop just reaped shows a decrease in infestation which is highly satisfactory.

During the year under review the doubled output and distribution of parasites came into full operation and worked smoothly and easily; altogether 103 million parasites were distributed over the island.

There was a certain amount of falling off in co-operation by the Planters in distributing the parasites due possibly to the discontinuance of weekly reminders, and the substitution of a *carte blanche* invitation to all Planters. The weekly reminder system was inaugurated because when parasites were first liberated, there were not enough to supply them to every estate in the Island. Certain plantations were therefore selected to form foci for distribution and spread of parasites, and to these plantations reminders or invitations were sent in rotation as the parasite supply permitted. When parasites became available to all, owing to increased equipment and improved methods, the *carte blanche* invitation given to all planters naturally included many who were unaccustomed to the routine of fetching and distributing parasites and who therefore responded irregularly or not at all. Nevertheless there was no difficulty in disposing of the 103 million parasites.

The increased control of *Diatraea saccharalis* through increased liberations has been fully apparent in the crop reaped in 1933 and on resumption of parasite liberations in February, 1933, and renewal of the weekly reminder system there has been a full and most satisfactory co-operation in the distribution of parasites.

It is hoped to give the full results of this work when the crop now being treated, and which will be reaped in 1934 has been analysed in the same manner as previous crops. As an indication, it can, however, be said that in the crop reaped in 1931, the average infestation of cane joints taking standard varieties at twelve factories was 27.3%; in 1932 it was 17.4% and in 1933 14.5%. Prior to 1931 the average joint infestation was over 30%, but for the present the results from 1931 only are given as they are absolutely comparable, and carried out on

an extensive and uniform scale. This annual reduction in infestation is shown even more decisively when the records obtained at the various factories are sorted out into varietal records of borer infestation. Percentage joint infestation is a recognised criterion of borer infestation, and as the figures have been obtained by the Departmental staff, under proper supervision, and as the climate and rainfall over the three years quoted have been very diverse it would appear legitimate to claim that definite results are being obtained by the use of *Trichogramma* against *Diatraea saccharalis* in cane fields. The moth borer problem, including as it does varietal differences in intensity of infestation, rainfall and temperature influences on the fecundity of the moth borer and its survival rate, in all stages, is obviously a very complex one and to secure a steady reduction in infestation, with increased parasite liberations, over such a complex series of factors, certainly gives encouragement for the continuance of this method of control.

As to whether still greater liberations of parasites are necessary to obtain a further noticeable reduction in infestation, remains to be seen.

If more are necessary, and they most probably are, the system is capable of almost indefinite expansion. The distribution of increased numbers could be accomplished with certainty and the cost per acre per annum would still be remarkably economic.

The use of *Lixophaga diatraea* to supplement the mass distribution of *Trichogramma* or if of provable and proved superiority, to supplant *Trichogramma*, is still projected. The re-introduction and mass rearing and distribution of *Lixophaga* in 1934 has therefore been recommended.

The area within a two mile radius of the point of liberation of a consignment of *Lixophaga* in May, 1930, was systematically examined at the end of March, and beginning of April in 1933. The parasite was thus given three years in which to build up a local population, but out of 2,640 sample dead hearts from 22 random selected fields, no trace of *Lixophaga* either as puparia, or in living *Diatraea* larvae was found. As all previous searches for *Lixophaga* have also given negative results, it is concluded that the 1930 introduction did not become established in Barbados.

The weekly collection of *Diatraea* eggs throughout the island, and computation of the monthly rate of parasitism by *Trichogramma* has been very considerably curtailed, and the time thus made available has been utilised for a series of experiments designed to give some information on the actual extent of egg deposition by *Diatraea* and on the rate of survival of larvae which hatch.

This experiment will extend over a full year, but the initial months of exact bi-weekly records which have been made are yielding information which is both new and of considerable interest and importance.

Extensive counts have been carried out during the year under review to determine the differences in varietal infestation of cane by moth borer. For this experiment randomised blocks of cane grown for maturity trials in both high and low rainfall areas, have been utilised. These results, when completed and worked out, will be correlated with other information accumulated.

Experiments have been started for obtaining information on the relation between the microclimate in cane fields and the external macroclimate in order to correlate such information, if possible, with extent of deposition of eggs by *Diatraea* and larval survival rate.

It is recognised that this is a branch of research work which, to be adequately pursued, would need laboratory and field equipment beyond the resources of this Department; nevertheless though only a few limited observations may be made it is possible that some information of practical value may be obtained.

ROOT BORER OF SUGAR CANE, *DIAPREPES ABBREVIATUS*, AND BROWN HARD BACK, *PHYTALUS SMITHI*.

A second introduction of *Tetrastichus haitensis* from Porto Rico, for the control of *Diaprepes abbreviatus* was made through the kind co-operation of Dr. G. Wolcott. This consignment was received in May, 1932, and liberations of laboratory reared stock were therefore possible at a period when *Diaprepes* eggs were abundant in the field. Altogether 12,000 *Tetrastichus* were bred up and liberated during the peak season of *Diaprepes*, but once again no parasites have been recovered from field collections of *Diaprepes* eggs.

In view of the negative results from this parasite introduction, and of the undoubted necessity of increasing the control over *Diaprepes* a series of soil treatment experiments were carried out this year. These experiments were designed to control the grubs of brown hard back (*Phytalus smithi*) as well as of the root borer *Diaprepes*. A large field of reaped cane, infested with grubs of both pests, was laid out in randomised plots, and eight different soil treatments carried out. Without giving full details it can be said that no treatment gave 100% kill of grubs in the cane holes, let alone in the cane banks, whilst in most cases the treatment was too laborious and expensive for general practice. The non-success of many of the treatments was due mainly to the impervious nature of the soil and not to lack of killing power of the solutions or fumigants used.

The control of both of these root pests of sugar cane still depends therefore upon proper co-operation and thoroughness in the collection of adults, destruction of grubs, and in the case of *Diaprepes* collection and destruction of newly laid egg masses.

The hand collection of adults is both a practicable and an economic proposition in Barbados, and has already proved of great use in reducing infestation.

The destruction of grubs in the soil can most effectively and economically be carried out by digging up and splitting or removing cane stumps as so often recommended, and by thorough ploughing of infested fields.

At the risk of constant reiteration, it must be repeated that these methods are effective, economic and practicable. Their only drawback is that they are old and familiar recommendations, and familiarity does occasionally breed laxity in practice.

It is possible that eventually a successful parasite will be found, or that a cheap treatment suitable to the soils of Barbados will be worked out. In the

meantime, the familiar control measures are the best and if prosecuted with vigour will certainly reduce the losses occasioned by these pests in Barbados.

OTHER PESTS.

Moderate progress can be reported in the regular use of sprays and adequate spraying apparatus for the control of scale insects. Up to date continuous action hand sprayers, as well as spray materials, can now be obtained retail in Bridgetown, and the use of such sprayers is increasing.

In some cases spraying with lead arsenate, with molasses as a sticker, is replacing the wasteful bag dusting of potato and other crops. Barium fluorsilicate and cryolite have also been tried out and are recommended in place of arsenicals for the spraying of legumes or fodder crops.

This year the damage caused by defoliators has been less than in previous years, due most probably to increased vigilance and prompt dusting or spraying of infested fields.

In this connection, namely the control of defoliators, army worms, cutworms, etc., a further importation of *Compsilura concinnata* was made through the courtesy of Dr. Collins, of the Gipsy Moth Laboratory, Massachusetts, U.S.A. Altogether 1432 puparia were received and the consignment arrived in such excellent condition that 1205 flies emerged and were liberated in the field.

Unfortunately the period (July) at which they were received from America did not coincide with the period during which army worms and cutworms are active in Barbados and no lepidopterous larvae could be located in any quantity at the period of liberation. No attempt has yet been made to recover this parasite, for it is realised that it may be years before any survivors have multiplied sufficiently to be discoverable.

With regard to *Euscepes batatae* the "scarabee" of sweet potatoes, little progress has been made beyond the definite recommendation given in Departmental Pamphlets 6 and 7; and until experiments can be carried out over a series of years, independently of the necessity for controlling other pests, it is not considered likely that any real progress can be made with this particular pest.

EXPORT OF BENEFICIAL INSECTS.

In response to a request from Dr. G. Wolcott, of Porto Rico, a consignment of adults and larvae of *Hyperaspis trilineata*, Muls. was made up from field material and despatched by air mail. This predator, which is to be used to control mealy bug infestation in Porto Rico arrived at its destination in very good condition. It is no doubt due to this *Coccinellid* which is very plentiful in canefields here that mealy bug infestation never reaches damaging proportions in Barbados.

LIXOPHAGA DIATRAEA IN BARBADOS.

1930—1933.

Early in 1930 arrangements were made with Dr. J. G. Myers for the introduction of *Lixophaga diatraea* from Cuba. A field of young cane was selected at Carrington in the St. George's Valley and a cage of 30 feet by 30 feet by 8 feet high was erected in the field so as to enclose about thirty-six growing cane stools. There were dead hearts in the stools so enclosed and in addition over 100 dead hearts with larvae in were cut from elsewhere and strewn among the canes in the cage to ensure a satisfactory population of *Diatraea* larvae.

On May 3rd a consignment of 186 *Lixophaga* puparia was received from Dr. Myers from Antigua where *Lixophaga* was also being liberated at that time.

The pupae were gummed on to cardboard slips and placed in large gauze-capped glass tubes so that all emergences could be scrutinised for hyper-parasites.

A total of 112 *Lixophaga* emerged, of which 82 were placed in the field cage, and 30 were liberated some distance away in the same field.

These arrangements were seen and approved by Dr. Myers on May 13th, and on his advice, the liberations were made in one field only.

The Lixophaga flies were seen in the cage, or resting on the gauze sides, for several days subsequent to liberation.

Eighteen days after liberation twelve shoots were cut at random from the stools inside the cage and examined for recovery of *Lixophaga;* similarly, at various periods subsequently, shoots were cut at random and dissected, but no trace of the parasite was ever found.

In July the cage was dismantled and removed to allow full growth of the canes.

On September 5th, 1930, Dr. Myers again visited Barbados, and 24 *Diatraea* larvae were obtained from the field of liberation but again no parasites were recovered. The test was however on too small a scale, and Dr. Myers stated that negative results would not necessarily mean that the parasite had not survived and that quite three years must elapse before a definite answer could be given.

In 1931 the reaped cane from the field of liberation was examined, but no parasites or any traces of them were found. Young bored canes from adjoining fields were also examined in April by Dr. Myers and Mr. Box and larvae dissected, but no parasites were found.

In May and June, 1931, a large number of *Diatraea* infested cane shoots were examined, and any larvae obtained were dissected, but results were again negative; since then every opportunity has been taken of examining standing cane for evidence of *Lixophaga,* but none has been found.

At the end of March 1933, it was decided that, as three years had elapsed, giving full time for the parasite to have spread around the area of liberation had there been any survivors in 1930, a systematic search of that area should be made.

Consequently a gang of ten workers was taken by lorry and set to cutting dead hearts from a number of fields within a two-mile radius of the area of liberation. Twenty-two fields were chosen as shown by the dots in the accompanying map; two of the fields moreover were in immediate proximity to the Carrington and Hampton factory yards, to which cane is brought from all around the surrounding country; hence, any flies emerging from the piled up canes in the yards would be most likely to migrate or be blown into these two fields. From each of the fields selected, 120 dead hearts were cut out; each of the ten workers selecting and cutting out twelve dead hearts which were likely to contain nearly fully grown *Diatraea* larvae. A total of 2,640 dead hearts was thus obtained.

These infested shoots were dissected in the laboratory, and the *Diatraea* larvae so obtained placed in a solution of chloral hydrate. All pupae and empty pupal cases were placed in jars. The larvae obtained were dissected whilst still fresh and the pupae were allowed to hatch, to ensure that no pupal parasites were present.

Separate records were made of each sample of 120 dead hearts from the various fields as follows.

Plantation.	Field.	Distance and direction from liberation.	Total shoots examined.	Diatraea larvae.	Diatraea Pupae.		Total
					Full.	Empty.	
Brighton	No. 1	2¼ miles WNW	120	18	8	7	33
	„ 2		120	18	13	10	41
Windsor	„ 1	1¾ „ W	120	30	18	11	59
Edgecumbe ..	„ 1	1 „ WNW	120	39	16	11	66
„	„ 2	1 „ NW	120	13	13	4	30
Halton	„ 1	1½ „ NNW	120	41	24	4	69
„	„ 2						
	„ 3	1½ „ N	360	125	46	16	187
	„ 4						
Chapel	„ 1	1¼ „ NNE	120	22	13	17	52
„	„ 2	1 „ NNE	120	11	10	7	28
„	„ 3	¾ „ NNE	120	29	16	14	59
Sunbury	„ 1	1 „ NE	120	13	14	11	38
„	„ 2	1 „ ENE	120	18	13	12	43
„	„ 3	½ „ ENE	120	9	12	9	30
Hampton	„ 1	½ „ E	120	19	13	8	40
Carrington ..	„ 1	¼ „ NW	120	9	11	7	27
„	„ 2	¼ „ SE	120	16	10	10	36
„	„ 3	½ „ S	120	15	9	5	29
„	„ 4	¾ „ SW	120	10	11	5	26
Hannays	„ 1	1 „ SW	120	14	7	13	34
„	„ 2	1 „ WSW	120	15	7	8	30
Total	22		2,640	484	284	189	957

From 2,640 damaged shoots, 484 living *Diatraea* larvae were obtained, 284 living *Diatraea* pupae, and 189 empty *Diatraea* pupal cases. No *Lixophaga* puparia full or empty were obtained. The 484 living larvae were all carefully dissected but neither *Lixophaga* nor any other internal parasites were found. The 284 *Diatraea* pupae were placed in jars in case parasites other than *Lixophaga* were present. Only *Diatraea* moths emerged.

In conclusion, no trace of *Lixophaga* was found in 2,640 *Diatraea* infested shoots, of which 36.25% still contained *Diatraea* larvae, pupae or empty pupal cases; and as the samples were taken from a comparatively wide area as shown in the accompanying map, it would appear, when previous searches are also considered, that *Lixophaga diatraea* has not established itself since the 1930 liberation. It is proposed however that a further search should be made in June over a more extended area of a 5 to 7 mile radius.

SECTION IX—METEOROLOGICAL OBSERVATIONS.

In recent years a system has been evolved whereby weather reports are issued during the hurricane season by the meteorological station of this Department on the request of other stations in the West Indies or of ships at sea, or on such other occasions as the officer in charge of the meteorological section of the Department considers advisable.

During the hurricane season 1932, eight reports were issued on request.

APPENDIX I.

METEOROLOGICAL OBSERVATIONS.

RECORDED AT THE METEOROLOGICAL STATION, CODRINGTON.

Height Above Sea Level 181 *Feet.*

Latitude 13°7′ 36″ N. Longitude 59° 35′ 57″W.

The following are summaries of the observations recorded for the year 1932. The details are given in Appendix II.

Barometric Pressure. The records refer to observations made at the hours of 9 a.m. and 3 p.m. only and are expressed in inches of mercury. During the year 1932 the mean pressure corrected for temperature and gravity and reduced to sea-level was at 9 a.m. 29.959 and at 3 p.m. 29.886, the highest pressure recorded being 30.107 at 9a.m. on February 5th and the lowest 29.755 at 3 p.m. on October 31st and November 1st. For the ten-year period 1922-1931 the average barometric pressure was at 9 a.m. 29.976 and at 3 p.m. 29.901 The highest pressure recorded at 9 a.m. during the ten-year period was 30.127 inches on January 22nd, 1925, and the lowest pressure recorded at 3 p.m. was 29.704 on October 30th, 1929.

Temperature. The daily mean maximum temperature for the year 1932 was 85.6°F. and the daily mean minimum 72.8°F. The maximum extreme for the year was 89.5°F. registered on September 26th and the minimum extreme was 63.0°F. registered on February 18th. The average daily mean temperature was 79.2°F., the highest monthly range 23.0°F., and the lowest 15.0°F., the mean monthly range being 18.3°F. For the ten-year period 1922-31 the daily mean maximum temperature was 85.4°F., and the daily mean minimum 72.6°F. During the ten-year period the average daily mean temperature was 79.0°F., the maximum extreme was 91.5°F. on August 23rd, 1927, the minimum extreme 63.2°F. on March 24th, 1925, and the average monthly range 18.5°F.

Tension of Vapour and Relative Humidity. The mean tension of vapour for the year 1932 was at 8 a.m. .789 and at 5 p.m. .772. The mean relative humidity was at 8 a.m. 76.1% and at 5 p.m. 73.8%.

Wind. The daily (24 hour period) mean velocity of the wind during the year 1932 was 9.8 miles an hour. Records were kept of half daily or 12 hour periods from 6 a.m. to 6 p.m. and 6 p.m. to 6 a.m. The maximum velocity for any such 12 hour period was 23.4 miles an hour recorded between 6 a.m. and 6 p.m. on June 28th and the minimum velocity was 3.0 miles an hour recorded between 6 p.m. and 6 a.m. on November 12th. The average daily (24 hour period) velocity for the ten years ended 1931 was 9.9 miles an hour.

Rainfall. The rainfall measured at the Government Meteorological Station during the year 1932 amounted to 56.89 inches. Rainfall was recorded on 223 days, the greatest fall being 2.20 inches on November 3rd. For the ten-year period 1922-31 the average rainfall was 47.11 inches and the average number of days annually on which rain fell was 182.

Rainfall of the Island. The average total rainfall for the year 1932 from 155 stations was 61.87 inches, being 1.70 inches above the average for the eighty-four years ended December 31, 1931, which was 60.17 inches.

APPENDIX II.

METEOROLOGICAL REPORT FOR 1932

DEPARTMENT OF AGRICULTURE, BARBADOS.

Height Above Sea-Level 181 *feet.*

Months	Mean Pressure reduced to 32° Fahrenheit, Latitude 45° and Mean Sea Level.					Temperature °F.								Tension of Vapour.			Relative Humidity					
	9 a.m.	3 p.m.	Mean.	Highest.	Lowest.	Max. Mean.	Min. Mean.	Max. Extreme.	Min. Extreme.	Mean for Month	Range for Month.	Dew Point 8 a.m.	Dew Point 5 p.m.	8 a.m.	5 p.m.	Mean.	8 a.m.	5 p.m.	Mean.	Velocity miles per hour.	Rainfall.	No. of Days on which rain fell.
January ...	29·988	29·904	29·946	30·058	29·790	83·7	70·8	86·0	63·5	77·3	22·5	69·9	70·3	·736	·749	·743	79·7	78·2	78·9	12·7	2·68	22
February ...	30·010	29·932	29·971	30·107	29·851	83·8	69·2	86·0	63·0	76·5	23·0	70·5	71·7	·752	·786	·769	79·8	80·2	80·0	10·5	·62	8
March	29·981	29·900	29·940	30·052	29·811	85·5	71·4	87·0	68·0	78·5	19·0	70·3	69·9	·741	·733	·737	74·0	70·5	72·3	10·6	2·24	15
April	29·960	29·878	29·919	30·025	29·828	86·8	74·0	88·0	70·5	80·4	17·5	69·6	69·5	·727	·724	·725	68·5	66·4	67·4	11·7	2·09	14
May	29·979	29·902	29·940	30·054	29·804	86·7	74·2	89·0	71·0	80·4	18·0	71·5	70·5	·773	·750	·761	70·5	68·0	69·2	11·0	3·51	14
June	29·980	29·919	29·950	30·056	29·862	86·3	74·1	88·0	71·0	80·2	17·0	72·8	71·9	·809	·783	·796	75·8	71·6	73·7	12·4	4·63	25
July	29·987	29·929	29·958	30·039	29·888	86·6	74·0	88·0	71·0	80·3	17·0	73·4	72·7	·825	·806	·816	76·2	75·9	76·0	9·6	3·63	20
August... ...	29·942	29·886	29·914	30·023	29·848	86·1	73·8	87·5	72·5	79·9	15·0	73·5	72·7	·828	·805	·816	78·0	74·4	76·2	7·8	10·01	23
September ...	29·927	29·858	29·892	30·010	29·779	87·5	74·5	89·5	73·0	81·0	16·5	74·0	73·2	·842	·821	·831	75·3	73·5	74·4	6·9	5·82	16
October ...	29·915	29·841	29·878	29·970	29·755	86·2	73·9	88·0	71·0	80·0	17·0	74·6	72·2	·859	·793	·826	79·3	73·9	76·6	6·5	5·97	20
November ...	29·896	29·820	29·858	29·940	29·755	84·9	73·1	88·0	71·0	79·0	17·0	73·7	72·4	·834	·800	·817	80·2	80·5	80·3	7·1	9·86	21
December ...	29·942	29·861	29·902	30·018	29·784	83·6	71·1	85·5	65·0	77·4	20·5	70·3	69·0	·745	·715	·730	76·5	72·8	74·7	11·0	5·80	22
	359·507	358·630	359·068	360·352	357·755	102·77	874·1	1050·5	830·5	950·9	220·0	864·1	856·0	947·1	9·265	9·367	913·8	885·9	899·7	117·8	56·89	223
	29·959	29·886	29·922	30·029	29·813	85·6	72·8	87·5	69·2	79·2	18·3	72·0	71·3	·789	·772	·780	76·1	73·8	75·0	9·8		

APPENDIX III.

Summary of Barbados Rainfall. From January to December, 1932.

NAME OF STATION.	No of Stations	January		February		March		April		May		June		July		August		September		October		November		December		Total	
		Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches
DISTRICT "A". St. Michael																											
Lowlands	18	17	3·58	5	·66	11	2·12	11	2·18	10	2·15	18	4·03	17	4·36	22	7·96	13	5·58	18	5·90	19	9·15	16	6·21	177	53·88
DISTRICT "B". Christ Church																											
Lowlands	17	16	4·09	5	·79	9	1·53	11	2·64	8	1·53	15	3·87	16	4·37	17	5·38	17	5·02	18	6·70	17	9·52	16	6·39	165	51·83
St. George																											
Highlands	10	15	5·18	7	1·19	13	4·40	11	3·44	10	2·16	19	5·73	18	5·07	23	10·06	18	8·75	20	7·72	24	14·57	18	8·25	196	76·52
Lowlands	13	15	4·29	6	·84	10	2·61	11	2·53	11	2·65	17	4·43	16	3·51	20	7·21	16	5·56	19	6·97	19	10·42	17	6·77	177	57·19
DISTRICT "C". St. Philip																											
Highlands	3	12	3·70	5	·61	9	1·51	13	2·12	12	1·99	16	3·85	18	3·85	19	5·65	17	5·74	19	5·82	22	9·12	17	6·10	179	50·06
Lowlands	19	14	4·07	6	·69	10	1·78	12	2·66	11	1·71	14	3·36	16	3·32	20	4·66	17	4·93	21	6·62	20	7·93	17	6·35	178	48·08
St. John																											
Highlands	13	14	5·16	7	1·02	11	2·73	13	2·88	12	2·11	19	5·57	19	5·12	21	8·47	19	9·18	20	7·86	24	13·22	18	8·80	197	72·12
Lowlands	4	9	3·25	4	·95	7	1·69	10	2·12	8	2·21	12	3·52	15	4·92	14	5·19	14	8·33	15	6·43	18	8·61	16	7·75	142	54·97
DISTRICT "D". St. Thomas																											
Highlands	8	19	6·16	8	1·41	12	3·31	14	3·05	13	2·60	21	4·99	19	5·95	23	9·98	18	8·74	21	8·91	23	15·16	19	8·49	210	78·78
Lowlands	8	19	5·27	7	·98	13	3·62	11	2·51	10	1·91	19	4·88	17	4·62	23	10·21	16	6·71	19	7·17	21	12·79	18	7·78	193	68·45
St. James																											
Highlands	1	13	5·12	5	2·04	14	1·52	13	2·48	7	2·85	12	4·76	13	4·41	18	7·75	18	8·70	17	6·27	20	10·24	20	9·16	170	65·30
Lowlands	8	17	3·47	6	1·18	10	1·94	12	2·14	9	2·10	19	4·50	17	4·37	20	10·64	14	6·55	17	6·30	20	10·59	17	5·75	178	59·53
DISTRICT "E". St. Peter																											
Highlands	5	12	4·15	6	1·57	7	2·07	9	2·92	7	1·94	13	4·42	14	4·00	15	6·15	15	9·92	16	5·79	16	9·36	17	7·53	147	59·82
Lowlands	8	15	3·61	7	1·17	8	1·71	12	2·27	7	2·16	17	4·38	17	4·16	20	7·88	17	7·82	18	5·89	17	8·73	19	6·22	174	56·00
St. Lucy																											
Lowlands	7	11	3·77	6	1·08	9	2·73	9	3·81	9	2·20	14	4·12	13	2·19	14	6·70	12	6·54	13	5·57	17	9·81	13	4·73	140	53·25
DISTRICT "F". St. Joseph																											
Highlands	7	19	4·64	8	1·11	12	3·56	14	2·26	13	3·13	20	4·32	20	5·53	21	7·12	21	9·06	21	8·29	23	14·85	19	9·99	211	73·86
Lowlands	2	13	2·91	5	1·19	11	3·07	9	2·02	11	3·36	13	5·49	16	6·60	14	7·24	17	8·53	17	8·49	20	14·55	18	13·24	164	76·69
St. Andrew																											
Highlands	3	17	5·31	10	1·97	10	2·07	13	2·93	10	2·10	17	4·74	15	4·40	15	6·31	19	8·94	17	6·35	21	9·81	20	8·11	184	63·04
Lowlands	1	7	4·13	4	1·45	8	1·60	16	3·41	8	1·67	12	4·61	11	3·25	16	6·37	17	9·64	13	5·44	16	8·30	10	6·33	138	56·20
Total	155	274	81·86	117	21·90	194	45·57	224	50·37	186	41·93	307	85·57	307	84·00	355	140·93	315	144·24	339	128·52	377	206·73	325	143·95	3320	1175·57
Average		14	4·31	6	1·15	10	2·40	12	2·65	10	2·21	16	4·50	16	4·42	19	7·42	17	7·59	18	6·76	20	10·88	17	7·58	175	61·87

SECTION X—PEASANTS' AGRICULTURAL EXHIBITION.

The usual Exhibition for Peasants and Elementary School children was held, by kind permission of the Queen's Park Committee, in the Queen's Park on Wednesday, November 30th, 1932.

The Exhibition showed a distinct improvement on the previous years and there is no doubt that the general standard of exhibits especially in vegetables has improved tremendously. Better types of beans, carrots, etc., are now general.

Some Aspects of the Flora of Barbados

BY

F. HARDY, M.A., Dip. Agric.

(*Concluded from last issue.*)

FINAL INSTALMENT.

(3) THE FRUIT TREES OF BARBADOS.

CHAPTER XX.

Fruit trees are not cultivated in Barbados to an extent sufficient to allow of an appreciable export trade, nor even sufficient always to supply local needs. Of those fruit trees that grow in the Island two classes may be recognized.

(A) Fruit trees which grow without special attention in gardens and orchards near dwelling houses in all parts of Barbados.

(B) Fruit trees which grow well only in special situations shielded from wind, and provided with a plentiful supply of water. Such conditions prevail in certain gullies in the more rainy (upland) districts of Barbados.

A. FRUIT TREES OF GENERAL DISTRIBUTION.

(arranged in approximate order of commonness)

1. *Mangifera indica* (Anacardiaceae) Mango.

A fairly large evergreen tree, with thick bark. The leaves are long, leathery, oval-shaped, and are grouped together in tufts at the ends of the twigs. The flowers are tiny and are arranged in large erect terminal panicles. The fruit is a yellow drupe, of size depending on the variety of the mango. It may be as short as two inches or as long as six inches by two-thirds as broad. The "stone" is flat and woody. In certain kinds of mango the flesh of the fruit is fibrous, and the flavour reminds one of turpentine. Certain grafted mangoes (such as the "Julie" mango) have non-fibrous flesh, and a flavour surpassing that of all other tropical fruits. The Mango flowers in Barbados in January and February, and the fruits are ripe in May to July. It is a native of the East Indies or of Tropical Asia, and was probably introduced into Barbados towards the end of the eighteenth century.

2. *Spondias lutea* (Anacardiaceae) Hog Plum.

A fair-sized deciduous tree, with many branches, and thick bark. The leaves are clustered together at the extremities of the twigs. They are impari-pinnate;—each consisting of 5 to 7 pairs of leaflets of average

length 2½ inches. The small flowers are arranged in loose panicles. The fruit is a purple drupe about 1 inch long and ½ inch broad. It has on it several (2 to 5) small protuberances left by the styles as they dropped off from the flower. The flavour is astringent, and usually not very agreeable. The tree sheds its leaves in January and bears flowers in April. Soon after the flowers are out, the new crop of leaves is produced. The fruits ripen in August to December.

3 *Spondias purpurea var.* (Anacardiaceae) Chili Plum.
A fair-sized deciduous tree, with bunched impari-pinnate leaves 6 inches long, and composed of 9 or 11 pairs of leaflets. The small red flowers are arranged in racemes along the branches. The fruit is a smooth, large-stoned, yellow drupe, oval in shape, and of length 1½ inches. The flowering, leafing and fruiting periods are the same as those of the "Hog Plum."

4. *Spondias purpurea.* (Anacardiaceae) Jamaica Plum.
This is botanically identical with the Chili Plum, but the fruit is purple instead of yellow. All the above mentioned plum trees are West Indian. The first may even be indigenous to Barbados. They were primarily possibly brought from Africa by ocean currents.

5. *Spondias dulcis* (Anacardiaceae) Golden Apple.
This is a small deciduous tree similar in habit to the plum trees. The fruit is a yellow drupe, 3 inches long possessing a large fibre-covered stone. The fruits ripen in November to January. The Golden Apple is a native of the Society Islands, and was introduced into Barbados in the early part of the 18th century.

6. *Citrus medica var: acida* (Rutaceae) Lime.
A small, shrubby, evergreen tree, with leathery, elliptical, fragrant leaves, and spiny branches. The waxy flowers and fruits are borne singly. The plant bears flowers and fruits (berries) almost all the year round especially in the wet season. It is grown in most gardens in all parts of the Island,—the sour fruit being chiefly employed for culinary purposes. The Lime originated in the East, and was introduced into Barbados soon after the date of settlement.

7. *Zizyphus jujuba* (Rhamnaceae) Dunk.
A small tree with tortuous branches, which bend downwards at their extremities. The leaves are small, elliptical, finely dentate, and covered below with downy hairs. In the axil of each leaf are two curved spines. The flowers are arranged in small, axillary cymes along the branches. They emit an offensive odour. The fruit is a small, 2-seeded drupe, resembling very much in appearance and flavour an overripe English Crab-apple. It is generally only eaten by children. The Dunk tree grows in gardens and waste places in most parts of the Island, and flowers generally twice during the wet season. The leaves are never entirely shed, but are most plentiful at the end of the wet season. The fruits are ripe usually in July and again in February. The Dunk is a native of East India and Malay. It was probably introduced into Barbados in the early 18th century, and has spread itself so as to become a common plant of certain associations.

8. *Malpighia glabra.* (Malpighiaceae) Barbados Cherry.
A much-branched, low evergreen tree with small leaves. Flowers;—numerous, usually in umbels of 3 to 6 flowers each, and pink in colour. Fruit:—a drupe almost spherical, diameter ¾ inch, bright red in colour with 3 to 4 separate, triangular stones, each with one seed. The tree produces several (as many as five) crops of fruit each year, most of them during the rainy season. The tree is South American and West Indian in origin. It was noted by Ligon in 1657, and may, therefore, be indigenous to Barbados.

9. *Anona squamosa.* (Anonaceae) Sugar Apple.
A small, more or less deciduous tree, with simple entire leaves. These are put out chiefly at the beginning of the wet season (May). The flowers appear in April or May. Each flower has 3 small, (¾ inch) green, fleshy petals and a small, conical, apocarpous ovary. The fruit is a globular, tuberculate, compound fruit of diameter about 2½ inches. It easily breaks up into segments when ripe, each segment containing one hard black shiny seed. The fruits ripen in September to January.

10. *Anona muricata.* (Anonaceae) Sour Sop.
Similar to the above, but less deciduous, or almost quite evergreen. The flowers possess large, green, convex petals. The compound fruit is large (7 inches long), ovoid and spiny. It has an acidic taste, and is used chiefly for flavouring ices. The fruiting period extends from September to January.

11. *Anona reticulata.* (Anonaceae) Custard Apple.
A small shrubby tree, not so common as the two last named. The compound fruit is globular, smooth, and 4 inches in diameter. Most of its leaves are produced in May, along with flowers. The fruits ripen in August to December. *Anona* is a native of South America and the West Indies. Its species may be indigenous to Barbados, since they are mentioned by Ligon (1657).

12. *Psidium guajava.* (Myrtaceae) Guava.
A shrub of height up to 10 feet. It grows wild in many parts of Barbados, and is especially common along waysides in the northern part of the Island. It may be an indigenous plant. The flowers are fragrant, white, and of diameter 1 inch. They possess numerous stamens and inferior ovaries. The fruit is a spherical berry, diameter 1½ inches, with numerous seeds embedded in a pinkish pulp. It is used chiefly for making guava jelly or preserves. The plant bears fruits most of the year, especially in the wet season.

13. *Persea americana* (=*gratissima*) Avocado Pear. (Lauraceae).
A fairly large evergreen tree, with elliptical leaves, and small flowers grouped in panicles. The flowers are produced in March. The fruit is a large pear-shaped berry, containing one very large seed. The fleshy layer is oily, and of thickness ¾ inch. It is used in salads. The skin is tough and green, or dark purple. The fruits ripen in July to December. The Avocado Pear is a native of South America, and was introduced into Barbados by man at some fairly remote date.

14. *Punica granatum=cicca* (Punicaceae) Pomegranate.
(See under "garden plants.")
Commonly grown in gardens. It is mentioned by Ligon (1657) as being native to Barbados.

15. *Phyllanthus distichus* (Euphorbiaceae) Barbados or Otaheite Gooseberry.
A low-spreading evergreen tree with numerous small leaves grouped in two rows (distichous) on the twigs. The male and female flowers are arranged in clusters all along the branches of the tree. The fruit is a globose, ribbed, green drupe, containing several (usually 4) seeds. It has an acid flavour, and is chiefly used in making preserves. The tree flowers and fruits twice a year in the wet season. It is a native of India and Malaya.

16. *Melicocca bijuga* (Sapindaceae) Genip or Ginep.
(Often wrongly called Akee in Barbados). A fairly tall evergreen tree, with pinnate leaves of two pairs of leaflets each. Flowers;—odorous, arranged in terminal panicles. Dioecious. Frequently a tree produces almost all male flowers. Fruits;—in clusters. Each, a spherical berry, 1 inch in diameter, green, with sticky pulp, enclosing two or three seeds. South American.

17. *Carica papaya* (Caricaceae) Papaw.
A herbaceous tree up to 15 feet high. Dioecious. The leaves are borne in a crown at the summit of the succulent stem. The leaf is large and palmate. The fruits of the female trees are borne in the axils of the leaves. They are orange-yellow in colour, large, (often 1 foot long), and round or oval in shape. The fruit is a berry, and contains numerous, parietally-placed seeds. The juice of the fruit yields papaine. The Papaw bears flowers and fruits all the year round. Place of origin,—South America and West Indies. It was grown in Barbados at the time of Ligon's visit (1657) and may be an indigenous plant.

18. *Mammea americana* (Guttiferae) Mammee Apple.
A medium-sized evergreen tree, with fairly large, oval, shiny, leathery leaves. The flowers are borne in the leaf axils, and are small, white and odorous. The fruit is a spherical drupe, 3—5 inches in diameter, with thick russet skin, and contains one or more seeds enclosed in a fibrous endocarp. The tree generally flowers twice a year, most prolifically in November, giving fruits in April. South American, and probably indigenous to Barbados.

19. *Citrus decumana* (Rutaceae) Shaddock.
A small tree with leathery leaves. The fruits are very large, and have a thick rind. Often they reach a diameter of 1 foot or over. When fully grown, they pull the branches of the trees down to the ground. The Shaddock is grown in a few gardens in Barbados, and is more widely distributed than the less hardy citrus trees (Grape fruit and Orange), to be described later. The tree was brought to Europe from China by Captain Shaddock, a Scotsman, and from Europe it reached the West Indies early in the 18th century.

(B) FRUIT TREES GROWN IN SHADY, MOIST AND PROTECTED LOCALITIES.

1. *Citrus decumana var: racemosa* (Rutaceae) Grapefruit.
   A small evergreen tree, with thick, leathery, fragrant leaves. The clusters of small, waxy flowers are produced in January to March, and the fruits (berries) are ripe in June to July. A second crop of flowers generally comes out in August, giving fruits in December. The Grapefruit originated in China.

2. *Citrus aurantium* (Rutaceae) Orange.
   Similar to the above, but the fruits are not so large and are sweeter. Flowering and fruiting periods as above. Originated in China.

3. *Citrus nobilis* (Rutaceae) Tangerine Orange.
   Similar to the above, but the fruits are smaller and thin-skinned. Grown only occasionally in Barbados. Citrus fruits are cultivated in orchards and gardens in the northern hilly and rainy districts of the Island, but not so extensively nowadays as formerly. They were introduced soon after the date of settlement (in 1625).

4. *Achras sapota* (Sapotaceae) Sapodilla.
   A fair-sized evergreen tree with many branches, the lower horizontal. The twigs are covered with a rust-coloured down. The leathery leaves occur in bunches at the ends of the twigs. They are 3 inches long, and narrow. The flowers are solitary in the leaf-axils. The fruit is a berry, in appearance somewhat like a roundish English potato. It contains several black shining seeds, embedded in a dark-brown, juicy pulp. The tree bears fruits most of the year, but especially in April to July. The Sapodilla is a native of South America and the West Indies, and is probably indigenous to Barbados. It is not common in the Island.

5. *Psidium cattleyanum* (Myrtaceae) Spice Guava.
   A shrubby tree, similar to the above. The fruits may be eaten as dessert. They are ripe generally in May to September. The tree guavas are of South American origin, and were probably cultivated in certain Barbados orchards from the earliest times.

6. *Psidium pyriferum.* (Myrtaceae) French Guava.
   A small tree,—otherwise similar to the common Guava. The fruit is larger and has a better flavour than the common Guava.

7. *Chrysophyllum cainito* (Sapotaceae) Star Apple.
   A medium-sized evergreen tree, with fairly large oval leaves of a dark-green colour above and a rich brown beneath. The flowers are borne in small clusters in the axils of the leaves all along the branches. The fruit is a spherical berry of diameter 3 inches. It is of a purple colour, and contains usually 4 perfected seeds (although as many as 10 might start developing from the ovules). The Star-Apple bears fruits chiefly in April to July. It is not common in Barbados. It is a native of the West Indies.

8. *Anacardium occidentale* (Anacardiaceae) Cashew.
A medium-sized, spreading, evergreen, tree, with fairly large, oval, leathery leaves, which are reddish in colour when young. The small flowers are collected in large terminal panicles. The fruit consists of 2 parts, (a) the fleshy receptacle, red in colour when ripe, pear shaped, 2—4 inches long. It has an acid flavour; (b) the nut, of a dark colour, kidney shaped, 1 inch long, with woody pericarp. The Cashew flowers in December to April and the fruits ripen in April to June. The tree is a native of South America and was probably introduced by man into Barbados early in the 18th century. It grows nowadays only in a few localities, chiefly in the Scotland District, on poor, dry, sandy soil.

9. *Blighia sapida* (Sapindaceae) Akee.
The true Akee as contrasted with the Genip which latter is often called Akee in Barbados, is a small tree with pinnate leaves, each of three or four pairs of leaflets 3 inches long. The flowers are small, white, fragrant and hairy. They are arranged in groups in the leaf-axils. The fruit is a three-sided, dehiscent, reddish berry 4 inches long, containing 1 or 2 black, shiny seeds. The seeds are partly enclosed in a white aril. The aril is said to be poisonous, but if properly cooked it is edible. The Akee is a native of tropical Africa and although common in the West Indies, especially Jamaica, it is rare in Barbados. There is one specimen of the tree in Queen's Park.

NOTE ON THE PERIODICITY OF THE FRUIT TREES OF BARBADOS.

From the above notes, the following general conclusions as to the periods of vegetative activity of the fruit trees of Barbados may be drawn:—

(a) In the case of the *deciduous* fruit trees, (i.e. those that completely shed their leaves once a year) the leaves begin to fall at the commencement of the dry season, so that during the months of December to April, the trees are bare. At the beginning of the rainy season, (i.e., in May or early June), the deciduous fruit trees put out their flowers. Soon after this, the new leaves make their appearance, and by the middle of the rainy season, these are fully expanded. The fruits, at the same time are ripening. Thus the fruits of the deciduous fruit trees of Barbados come into season between the months of August and December.

e.g. Plums, Golden Apple, Sugar Apple, Sour Sop, Custard Apple.

(b) In the case of the *evergreen* fruit trees, the leaves are never altogether absent from the trees, but most of the old leaves are shed in the dry season, and most of the new ones are produced in the wet season. The flowers of the evergreen fruit trees are usually put out during the dry season, and the fruits ripen in the early part of the next rainy season; i.e., the fruits of the evergreen fruit trees come into season chiefly during the months of June and November.

e.g. Mango, Avocado Pear, Citrus, Mammee Apple, Cashew.

The distribution and intensity of the rainfall during the wet months of the year, however, greatly influence the time of flowering and fruiting of the evergreen fruit trees. In many instances, these irregularities cause the production of more than one crop of flowers and fruits in the rainy months, or of none at all.

e.g. Cherry, Dunk, Gooseberry, Guava, Genip, Sapodilla, Star-Apple.

(4) THE GARDEN PLANTS OF BARBADOS (SHRUBS AND HERBS)

CHAPTER XXI.

These are almost all introduced plants. In the lists given below it is to be understood that (unless otherwise stated), each plant has been introduced into Barbados through the agency of man.

In order to enable the student to appreciate the botanical relationships of the different species, the garden plants of Barbados have been arranged in their Families or Natural orders. The use of a dictionary of plants (such as that compiled by Willis; see Bibliography, No. 3) is all that is required for the acquirement of more detailed knowledge of the plants in the list. The value of a compilation of names of the chief garden plants of Barbados, therefore, chiefly lies in its serving as a guide to literature on the subject, and in its indicating the range of plants which are grown with success under local conditions. Some attempt has been made to trace the origin of the Barbados garden plants, and, in as many cases as possible, to supply the vernacular or common name of each. Difficulty has been experienced with the assignation of the common names, since, in Barbados, most garden (as well as wild) plants are known each by several names. As far as possible, the best-known of the synonyms are given in the lists.

(A) MONOCOTYLEDONS.

PANDANACEAE.

Pandanus utilis. Screw-Pine.
Possesses prop roots. Place of origin South Sea Islands.

GRAMINEAE.

Bambusa spp. Bamboo.
Very rare in Barbados. Probably introduced.

Coix lacryma. Job's Tears.
Possesses pear-shaped, hard swellings at the base of each inflorescence. A native of India.

Arundo donax. Variegated Reed.
A bushy grass up to 6 feet high. Leaves pale. Inflorescence a large panicle. Mediterranean.

PALMAE.

Livistonia sp. Livistonia Palm.
Possesses fan-leaves. India.

Thrinax spp. Thatch or Fan Palm.
West Indian. (*Thrinax barbadense* is said to be indigenous to Barbados, but is rarely, if ever, seen growing wild nowadays).

ARACEAE.

Anthurium sp. Anthurium of conservatories.
Possesses broad, red spathes. Probably of South American or West Indian (Trinidadian) origin.

Caladium sp. (e.g. *bicolor*). Variegated Caladium.
Possesses large peltate pink-and-green leaves. South American origin.

COMMELINACEAE.

Tradescantia (=*Rheo discolour*). Moses-in-the-bulrushes. West Indian.

Zebrina pendula. Wandering Jew.
Very much like the common Pond Grass, but has larger blue flowers and purple leaves. West Indian.

LILIACEAE.

Dracaena spp. Dragon Tree.
Erect plants up to 12 feet high. The stem has few branches. Leaves terminal, 2 feet long, green or red in the different species.

Sanseveria guineensis. Hemp.
Common in rock borders. Possesses stout, fibrous, dark-green leaves, with mottled, whitish V-shaped bands across them. Bears flowers in March. African or Indian.

Gloriosa superba. Gloriosa.
Possesses leaf-tendrils. A climber. African.

AMARYLLIDACEAE.

Eucharis grandiflora. Eucharis Lily.
Grows wild on the banks of the Amazon.

Hippeastrum puniceum (=*equestre*). Easter Lily or Barbados Red Lily.
Indigenous. Grows wild in gullies. Origin, West Indies and Tropical America.

Crinum amabile—Lily.
Flowers arranged in an umbel, drooping, bell-shaped, white, with pinkish stripes. East Indies.

Hymenocallis caribbea (=*Pancratium caribbaeum.*) Spider Lily.
Flowers twice a year. The flower possesses six long, narrow, perigonal lobes (petals). Stamens;—long and inserted on a crown. West Indian.

Zephyranthes (=*Amaryllis*) *tubispatha*—Barbados Snowdrop.
A small plant, (up to 1 foot high), grown in borders. Flowers white, and not unlike the English Crocus in shape. West Indian and perhaps indigenous.

Zephyranthes carinata. Snowdrop.
Similar to the above, but the flowers are larger and pink in colour. West Indian.

CANNACEAE.

Canna spp. & vars. Canna.
Flowers: red, yellow, or red, variegated with yellow. Flowering period August to December. Indian.

ORCHIDACEAE.

e.g. Oncidium papilio &c., *Catasetum spp., Cattleya spp., Dendrobium spp., Epidendrum spp.* Orchids.
Many genera, species and varieties are cultivated in conservatories with some success. Many of these are imported from South America, (Guiana, &c.)

(B) DICOTYLEDONS.

POLYGONACEAE.

Antigonon leptopus. Coralita.
A favourite climber. Has stem-tendrils, and bears pendulous racemes of pink flowers, which are borne in December and January. A variety with white flowers is also cultivated.

Antigonon sp.. (?*cinerascens*).
This bears pink flowers which are larger and more open than those of the common Coralita. Place of origin of *Antigonon*: Mexico.

AMARANTACEAE.

Gomphrena globosa. Bachelor's button.
An annual. Flowers: small, with crimson bracts, and arranged in a head. There is also a white variety. Place of origin, East Indies.

Amarantus gracilis (=*caudatus*) Love-lies-bleeding. Red Caterpillar, &c.
Flowers with crimson bracts, arranged in long cylindrical spikes. Cosmopolitan.

Celosia cristata. Crimson Cockscomb.
A monstrosity, in which the branches of the inflorescence are united laterally, giving a peculiar crested effect.

NYCTAGINACEAE.

Bougainvillea glabra. Bouganivillea.
A favourite creeping and climbing shrub, whose large showy, purple floral bracts are often mistaken for petals. The bracts of the species *B. glabra* soon turn brown.

B. glabra var. sandariana. Bougainvillea.
This has larger and richer-coloured (magenta) bracts, which do not wither so quickly as the last.

B. spectabilis var. laterita. Bougainvillea.
This has brick red (terra cotta) bracts.

Bougainvillea (species or var: unknown)
This is a new species or variety with crimson bracts. It is known locally as "Mrs. Butt." Place of origin of *Bougainvillea*: South America and Mexico.

CARYOPHYLLACEAE.

Dianthus spp. & vars. Carnations and Pinks.
Many common European species and varieties are cultivated in Barbados, but with little success.

CRUCIFERAE.

Iberis amara & vars. Candytuft.
European.

Alyssum sp. Sweet Alyssum.
European.

ROSACEAE.

Rosa spp. & vars. Double Rose.
The common English and American florists' varieties are cultivated, often with great success in Barbados. They grow best on their own roots, budded plants not being so satisfactory. Many of the varieties seem to degenerate under cultivation.

LEGUMINOSEAE.

Caesalpinia pulcherrima. Barbados Pride. Flower Fence.
The only shrubby leguminious plant cultivated in gardens of Barbados. There is a red-and-yellow flowered variety and a pure yellow-flowered variety. A very common plant in hedges. Widespread in the Tropics.

GERANIACEAE.

Geranium spp. & vars. Pelargonium spp. & vars.
The Scarlet Geranium is the most commonly grown but it does not flourish in Barbados. Introduced from Europe.

TROPELACEAE.

Tropeolum spp. Nasturtium.
Place of origin, South America, but probably introduced from England. Do not grow well in Barbados.

MALPIGHIACEAE.

Galphimia (=Thryallis) glauca. Canary Plant.
A common shrub, with numerous yellow flowers. Mexican.

EUPHORBIACEAE.

Codiaeum variegatum, &c. Croton of Gardens.
Very commonly-grown shrubs, with showy variegated leaves. Australian, &c.

Poinsettia pulcherrima. Poinsettia.
A handsome shrub, with [illegible] floral leaves of a bright scarlet colour. Grows wild on the mountain slopes of Mexico.

Acalypha spp. Acalypha.
Shrubs with variegated leaves. Indian, &c

[illegible]
[illegible]

Euphorbia spp.
Various. [illegible] are found occasionally in gardens. A common one is a candelabrum-like xerophyte with [illegible] angular, green stems devoid of leaves.

[illegible]
Indigenous. Often used as a hedge in which case it is kept trimmed. Ligon describes the Physic Nut as the most useful of the indigenous plants of Barbados, and "of a good height" (18 feet.) It is [illegible] common nowadays.

[illegible]
[illegible]
[illegible]

[illegible]
Hibiscus [illegible] Common Hibiscus.
A very common ornamental shrub. Flowers [illegible] A double variety is also grown, and also a pendulous-[illegible] variety. Hedges of Hibiscus are not very common in Barbados.

Hibiscus sabdariffa. Chinese Hibiscus.
Petals, lanceolate.

Hibiscus mutabilis. Changeable Rose Hibiscus.
Not common. Flowers large [illegible] in Grenada are white at mid-day, pale-red, and at night, purplish-red. Probable place of origin of Hibiscus—East Indies.

Althaea rosea & vars. Hollyhock.
[illegible] Rose Mallow, [illegible] in Barbados, especially the [illegible] variety.

VIOLACEAE.

Viola odorata. Violet.
[illegible] Cultivated [illegible] in some local gardens, especially red in [illegible]

Viola tricolor. Pansy.
European. Seldom thrives in Barbados.

PASSIFLORACEAE.

Passiflora laurifolia. Water Lemon.
Grown on fences. The fruits are edible.

Passiflora quadrangularis. Granadilla.
Passiflora is a South American and West Indian genus.

BEGONIACEAE.

Begonia spp. & vars. Begonia.
The commonest garden variety is the pink Begonia. Not indigenous to Barbados, but indigenous to other West Indian Islands, e.g., Jamaica, St. Domingo, Martinique, &c.

CACTACEAE.

Cereus spp. Cactus.
Several (at least three) climbing species of *Cereus* are cultivated in gardens in Barbados, and also one or two columnar species. Certain of them possess large, remarkably odorous flowers, which open at night. South American and West Indian.

Phyllocactus spp.
Globular Cactus. Occasionally grown in Barbados.

Pereskia aculeata. Barbados Gooseberry.
Possibly indigenous. A prickly climbing shrub, possessing true, expanded, green leaves. Fruit, an edible berry.

PUNICACEAE.

Punica granatum. Pomegranate.
Often grown in gardens as a shrub. A double variety (known as the Pomegranate rose) is also grown.

LYTHRACEAE.

Lagerstroemia indica vars. Queen of Flowers.
Shrubs possessing showy white, pink or mauve flowers. East Indies.

COMBRETACEAE.

Quisqualis indica. Quisqualis.
A common liane, possessing numerous clusters of flowers which attract many Sphingid moths in the evening. The flowers are long and tubular, with star-shaped, recurved corollae. Colour, white on opening, turning deep red towards evening. Place of origin. East Indies.

PLUMBAGINACEAE.

Plumbago capensis, Plumbago rosea, Plumbago zeylanica. Blue, Pink, and White Plumbago.
South African and Indian. Common flowering shrubs.

OLEACEAE.

Jasmium spp. Jasmine or Jessamine.
A common climber on fences. Place of origin, Arabia and East Indies.

APOCYNACEAE.

Allamanda carthartica. Allamanda, Yellow Bell.
A trailing shrub possessing large, funnel-shaped flowers, and milky latex. Fruits are not often produced.

Allamanda violacea. Pink Allamanda.
This may be a genus other than *Allamanda*, or at least another species of *Allamanda*. The fruit is commonly produced. It is a schizocarp consisting of two follicles placed in a straight line and pointed at their ends. Seeds, each with a parachute of hairs. *Allamanda* is a native of South America.

Tabernaemontana sp. Jasmine Bush.
A shrub possessing numerous white, odorous flowers of one inch diameter. Place of origin, East Indies.

Vinca rosea & vars. Periwinkle.
A woody herb possessing star-like, rose-coloured flowers. A variety (*alba*) has a white flower, and another (*?occellata*) white, with a red ring in the centre. *Vinca* is wild in many places in Barbados. It is a West Indian plant, but was probably introduced into Barbados by man.

ASCLEPIADACEAE.

Stephanotis floribunda. Stephanotis.
A liane. Place of origin, Madagascar. Fruit, a large fleshy follicle. Seeds, each furnished with a parachute of hairs.

Hoya caruosa. Wax Flower.
The flowers occur in umbels of a pink colour. Native of East Indies.

CONVOLVULACEAE.

Porana volubilis. Coralilla.
(Or probably more correctly Coronilla, from "corona"—a crown). A favourite climber. Bears dense pannicles of small, white, odorous flowers. Flowering period, near Christmas. Place of origin, East Indies and Malay.

Argyreia speciosa. Cephalic Vine.
A climber possessing very large heart-shaped leaves, which are white beneath. Flowers, large and white. East Indies.

Ipomea bona-nox. Moon Flower.
A large night-blooming Convolvulus. A climber. Possesses heart-shaped leaves, and large odorous white flowers.

Ipomea palmata. Purple Ipomea.
A climber. Flowers, bell-shaped, 2 inches long, deep purplish-crimson colour. Leaves with five leaflets. Egyptian.

Ipomea rubro-coerula. Blue Ipomea or Morning Glory.
A climber. Possesses large, cobalt-blue, funnel-shaped flowers. Mexican.

Quamoclit vulgaris (=*Ipomea quamoclit*). Sweet William or Maiden's Tresses.
A delicate climber, with small palmatifid leaves and small flowers, one inch in length, of a rich crimson colour.

POLEMONIACEAE.

Phlox drummondii, vars. Phlox.
Introduced from North America or Europe. A favourite border plant. Grows well in Barbados.

BORAGINACEAE.

Heliotropium peruvianum. Heliotrope.
Cultivated (as in England) for its sweet-scented flowers.

Myosotis sp. Forget-me-not.
Introduced from Europe. Grows freely in Barbados.

VERBENACEAE.

Verbena spp. & vars. Verbena.
A prostrate creeping plant, with rose, mauve-coloured or white flowers. Introduced from Europe.

Petrea volubilis. Petrea.
A liane with long, pendulous racemes of blue flowers. The flower possesses a double calyx, the outer whorl of which is star-shaped and blue. The inner calyx is small, and encloses a tiny purplish corolla. The inner calyx and corolla drop off soon after the flower opens, but the outer calyx persists in the fruit. Flowers in January, April, and again in October. South American and West Indian.

Duranta plumieri. Duranta.
A prickly shrub possessing pendulous compound racemes of numerous lilac-coloured flowers. The numerous yellow fruits form a conspicuous part of the plant. South American and West Indian.

Holmskioldia sanguinea. Chinaman's Hat.
Possesses disc-shaped, persistent, scarlet calyces. Indian. Not common in Barbados.

Clerodendron siphonanthus. Chandelier Plant.
A shrubby herb with large flowers arranged in panicles. East Indies. Rare in Barbados.

LABIATAE.

Salvia splendens. Scarlet Salvia.
Small shrub. Flower, tubular, one inch long, with scarlet calyx and corolla, the latter dropping out easily. Brazilian.

Salvia coelestina. Blue Salvia.
A low herb. Flowers, small. Mexican.

Coleus spp. Variegated Coleus.
European.

SOLANACEAE.

Solanum spp.
Several species of climbing solanum are grown in Barbados. The flowers are usually arranged in pendulous racemes, and in certain cases have a sweet smell, e.g., *S. seaforthianum*—Lilac. West Indian.

Petunia violacea. Petunia.
Both single and double varieties of *Petunia* are grown in Barbados. South America.

Cestrum nocturnum. Lady-of-the-night.
A shrub which bears cymes of small, greenish-yellow flowers, which give out at night an overpowering sweet scent. West Indian.

Nicotiana tabacum. Tobacco plant.
Once cultivated in Barbados, but only to a very small extent nowadays. It is grown in gardens as an ornamental plant. South American.

Capsicum frutescens. Nigger Pepper.
Probably an indigenous plant. Fruits, red, elongated, small berries.

Capsicum baccatum. Bird Pepper.
Probably a hybrid derived from the above. Fruits, red, spherical, very small. Varieties of *C. baccatum* have larger fruits.

Capsicum annum. Bell, Bonny, or Bonnet Pepper.
Possibly introduced from Europe. Fruits, red, conical and large (two inches long).

SCROPHULARIACEAE.

Russelia juncea. Antigua Heath.
A much-branched, leafless shrub, which bears red tubular flowers. Mexican.

Antirrhinum majus. Snapdragon.
European. Grows well in gardens in Barbados, and is common.

BIGNONIACEAE.

Bignonia unguis-cati. Cat's Claw.
A slender climber which climbs by modified stems whose extremities are hooked. Flowers, large, yellow, funnel-shaped. Fruit, a flat capsule, 1½ feet long. Seeds, winged laterally. West Indian.

Bignonia magnifice. Purple Bignonia.
A vigorous climber.

ACANTHACEAE.

Thunbergia fragrans.
A climber possessing white flowers. Introduced from the East Indies, but grows wild in many parts of Barbados.

Thunbergia alata. Yellow Thunbergia.
Possesses large flowers.

Eranthemum spp. Justicia.
A shrub possessing variegated leaves and curved, purplish-crimson flowers. East Indian.

RUBIACEAE.

Portlandia grandiflora. Portlandia.
A shrub possessing large, tubular, white flowers which emit a powerful sweet scent. West Indian.

Ixora coccinea and other spp. Ixora.
Several varieties are grown in Barbados. The chief are the brick-red and the yellow-flowered *Ixoras.* They seldom fruit.

Gardenia spp & vars. Gardenia.
The double Gardenia and the single (Cape Jesamine) are cultivated occasionally.

Pentas carnea. Pentas.
A herbaceous plant possessing lilac flowers. The commonest is a variety possessing long-styled flowers, although occasionally a variety with short-styled flowers occurs in gardens.

COMPOSITAE.

Helianthus annus. Sunflower.
Seeds brought from Britain. Grows fairly well in Barbados.

Zinnia spp. & vars. Red, Pink, Yellow Zinnia.
Mexican.

Coreopsis (=Calliopsis) spp. Yellow Coreopsis.
Tropics.

Cosmos spp.
Of various shades; the commonest is orange. Petals serrated.

Calendula spp. Marigold.

Chrysanthemum spp. & vars.

(C) GYMNOSPERMAE.

CYCADACEAE.

Cycas revoluta, Cycas circinata. False Sago Palm.
The larger (*C. circinata*) occasionally produces fruits, but not freely.

(D) PTERIDOPHYTA.

FILICINEAE (Leptosporangiatae).

Adiantum spp. Maiden-hair Fern.
A well-known species, which is said to have arisen locally is *A. farleyense,* possessing large crinkled leaflets.

Asplenium spp.

Gymnogramme chrysophylla. Golden Fern.
Introduced into Barbados from others of the West Indian Islands.

Gymnogramme pulchella. Silver Fern.
Indigenous and wild in Barbados.

(5) THE FOOD PLANTS GROWN IN BARBADOS.

(OTHER THAN FRUIT TREES)

INCLUDING ALSO CERTAIN PLANTS OF ECONOMIC IMPORTANCE.

CHAPTER XXII.

1. *Saccharum officinarum* (Gramineae) Sugar-cane.
   Probably introduced into Barbados in 1640 (or thereabouts), 15 years after the first British colonization of the Island. Ligon states that the first plants were obtained from Pernambuco. The original home of the cane is probably the South Pacific Islands. Sugar-cane is the staple crop of Barbados.

2. *Ipomea batatas* (Convolvulaceae) Sweet Potato.
   Possesses swollen roots. Cultivated chiefly for local consumption. Probably introduced in the early days, soon after the first settlement of the Island, from South America, its original home.

3. *Dioscorea alata* (Dioscoreaceae) Yam.
   Possesses true tubers. Stated by Ligon to have been brought from Africa by slaves. Place of origin, probably East Indies.

4. *Artocarpus incisa* (Moraceae) Breadfruit.
   A medium-sized evergreen tree with large shiny, pinnatifid leaves, grouped in bunches at the ends of the otherwise bare branches. The leaves have large, sheathing, deciduous stipules. Dioecious. Male flowers arranged in fleshy spikes; female in numerous, globular heads, from which develop the large multiple fruits. These are seedless and are used as a vegetable. The plant was introduced into the West Indies from the South Sea Islands by Captain Bligh in 1793, along with many other "choice and curious plants."

5. *Colocasia esculenta* (Araceae) Eddoe.
   Possesses fleshy corm like rhizomes. Introduced from the East Indies into Barbados before 1750.

5a *Xanthosoma sagittifolium* (Araceae) Tannia Eddoe.
   Similar to the above, but producing larger rhizomes. Introduced along with the Eddoe.

6. *Zea mais.* (Gramineae) Indian Corn, Maize.
   Cultivated in Barbados from the date of settlement (1625). Original home, probably South America.

7. *Musa sapientum* (Musaceae) Banana.
   Not yet grown extensively in Barbados. Introduced soon after settlement. Place of origin, probably Tropical Asia. The plant is said to have been introduced from China into the Canary Islands before A.D. 1500.

8. *Musa paradisiaca* (Musaceae) Plantain.
One of the chief food plants of the slaves in early days. Still cultivated to some extent. Place of origin, Tropical Asia.

9. *Manihot utillisima* } (Euphorbiaceae) Bitter Cassava.
Manihot palmata. } Sweet Cassava.
Cultivated for starch which occurs in the swollen roots. Introduced into Barbados (probably from Brazil, their place of origin) at the time of settlement.

10. *Cucurbita pepo* (Cucurbitaceae) Pumpkin.
Introduced into the Island before 1750. Original home doubtful, probably Mediterranean region.

11. *Cucurbita pepo var. melopepo?* (Cucurbitaceae) Squash.
A small fruit, 3 inches long. Date of introduction and place of origin; as above.

12. *Cajanus indicus.* (Leguminoseae) Pigeon Pea, or Green Pea.
A shrub, 6 to 12 feet high. Introduced before 1750. Place of origin, East Indies.

13. *Dolichos lablab* (with varieties) (Leguminoseae) Bonavist.
A creeper. Cultivated in Barbados from the date of settlement. Place of origin, East Indies.

14. *Vigna catjang.* (Leguminoseae) Black-eyed Pea.
An annual, creeping plant, bearing long pods. Frequently used as a green dressing. Introduced probably at some recent date.

15. *Phascolus lunatus* (Leguminoseae) Lima Bean, Sugar Bean.
A biennial creeper. Several varieties are cultivated for food and as green dressings. Probably West Indian, but not indigenous to Barbados.

16. *Arachus hypogaea* (Leguminoseae) Ground-Nut, Pea-Nut.
A small annual, trailing plant which buries its ripening pods in the earth. Grows well only in light soil. Brazilian.

17. *Cocos nucifera* (Palmae) Coconut Palm.
This is cultivated occasionally near the sea shore in different parts of the Island, but nowhere to any appreciable extent. It is doubtful whether the Coconut belongs to the aboriginal flora of Barbados, or of the West Indies. It is said to have been introduced into many of the West Indian Islands from the South American Tropics (its probable place of origin) by the Spaniards. In Barbados, the Coconut suffers much from insect pests (chiefly scale-insects).

18. *Hibiscus esculentus* (Malvaceae) Okro or Ochra.
An annual. Height up to six feet. Cultivated by peasants for the edible young fruits, which are cooked as vegetables. Introduced into Barbados before 1750, probably from the East Indies or Egypt.

19. *Maranta arundinacea* (Marantaceae) Arrowroot.
Introduced at some date before 1750, and cultivated to a limited extent (chiefly on the bare slopes of the Scotland District Hills) for the starch contained in its rhizomes. Place of origin, probably Tropical America.

20. *Zingiber officinale* (Zingiberaceae) Ginger.
Cultivated similarly to Arrowroot. Introduced before 1750. Original home, probably India or Asia.

21. *Canna edulis* (Cannaceae) Tous-les-mois.
Occasionally cultivated in the Scotland District. Place of origin, India.

22. *Sorghum vulgare* (Gramineae) Guinea Corn.
Introduced from Mediterranean region. Occasionally cultivated by peasants, and also grown on sugar estates.

23. *Sorghum saccharatum* (Gramineae) Imphee.
Introduced from India. Cultivated as food for animals along with Guinea Corn.

24. *Aloe vera* (=*A. vulgaris* =*A. barbadensis*) (Liliaceae) Barbados Aloe.
Used medicinally, but not nowadays exported. Little cultivated at the present day. Occasionally found wild. Introduced at the date of settlement, probably from the Mediterranean region.

25. *Lycopersicum esculentum* (Solanaceae) Tomato.
This has long been cultivated on sugar estates and in kitchen gardens. Introduced from South America.

26. *Brassica juncea* (Cruciferae) Mustard.
Cultivated chiefly by peasants. Introduced from Europe.

FODDER GRASSES. (Gramineae)

27. *Andropogon pertusus* (=*Amphilophis intermedia var. acida. sp. nov.* Stapf) Sour Grass.
Origin very doubtful. Stapf (1916) suggests that it is a hybrid derived from an indigenous species (which he names *Amphilophis feracidula*) and an Australian or Indian species introduced into Barbados before 1830.

28. *Panicum maximum.* Guinea Grass.
First introduced accidentally from Jamaica, into which Colony the plant had been imported in 1744 from Guinea.

29. *Panicum muticum.* Para grass.
Not very much cultivated. Needs a very wet climate or wet soil.

ECONOMIC PLANT.

30. *Gossypium barbadense* (Malvaceae) Cotton, Sea Island Cotton.
Sir George Watts, in his monograph on *Gossypium*, suggests that this plant is a hybrid between *Gossypium vitifolium* (which is practically synonymous with the original Linnaean *G. barbadense*), an indigenous, perennial cotton, and *G. brasiliense*, a South American plant. *G. vitifolium* probably was the cotton cultivated in the Antillean Islands in the 18th and early 19th centuries. Ligon mentions cotton as one of the cultivated crops of Barbados in 1650, soon after the colonization of the Island by the British in 1625. This plant was probably also *G. vitifolium*. Occasionally, specimens of it are to be seen at the present day in Barbados growing near labourers' huts. The extensive cultivation of Sea Island Cotton in Southern U.S.A. during the 19th century caused West Indian growers to abandon the crop in favour of sugar. The failure of sugar-cane cultivation towards the end of the 19th century, and the falling off in supplies of American cotton, induced West Indian planters again to try cotton. In Barbados, the export of cotton in 1901–1902 was practically nil, but in 1907–1908 it was nearly one million pounds weight. In 1912–1913 the export had fallen off to less than half that amount, and during 1915–1916 it had dropped still further to just over one hundred thousand pounds weight. During the present season 1916-1917, most of the available land in Barbados is under sugar cane cultivation.

PART III.

CHAPTER XXIII.

THE ORIGIN OF THE FLORA OF BARBADOS.

In considering the origin of the flora of Barbados, one must first learn as much as possible about the past history of the Island, not only from accounts in books but also from the testimony of the rocks of which the Island is composed. When discussing the geological history of Barbados (Part I, Chapter IV), the conclusion was reached that the Island is a true oceanic Island, that is to say, it has never at any time since its latest emergence from the sea been geographically connected with other islands of the Antillean Chain, or with Trinidad or with the mainland. It follows therefore that any plants which now populate Barbados must have been carried across the sea from land areas more or less remote. Plants may be transmitted from one place to another across water barriers either by natural agencies, (such as ocean currents, winds, and birds), or by artificial means, that is, by the agency of man who either consciously or unconsciously carries, or causes to be carried, seeds or other parts of plants capable of development into mature individuals.

Let us consider first the mode of action of the *natural means* of plant dispersal. The efficiency of ocean currents, winds and birds, in bringing about the populating by plants of a newly-exposed land mass, has been urged by Darwin and other botanists. It has received direct demonstration in the case of the populating of Krakatau (an Island in the Malay Archipelago, lying between Sumatra and Java) by plants introduced from neighbouring Islands. A recently published account of the observations made by several botanists on the new flora of Krakatau will be found in a book mentioned in the Bibliography (No 24.) In 1883, the Island of Krakatau was partially destroyed by violent volcanic explosions. Every vestige of life was exterminated, and a fresh substratum, which the great heat of the volcanic activity had completely sterilised, was exposed. In 1906, a party of botanists who spent a few hours on Krakatau, collected 137 species of plants. They found the vegetation by this time so dense that it was only with great difficulty that they were able to penetrate beyond the coastal belt. Investigations proved undoubtedly that plant species of the new flora of Krakatau had been introduced into the island from the neighbouring islands, of which the nearest, (except Sebesi, a small island 12 miles distant) are Java and Sumatra, separated from Krakatau by a stretch of water of width about 25 miles. Further investigations yielded results which demonstrated to a striking degree the efficiency of ocean currents, winds and birds as natural means of plant dissemination. Important conclusions were also drawn as to the parts played by each of these agents in the final repopulating of Krakatau with plants.

There are many other examples on record of the methods whereby an isolated land area such as an oceanic island may become colonised by plants (and by animals also), and considerable knowledge of the process of geographical distribution of plants has been accumulated by naturalists. (See Bibliography, Nos. 26, 27, 29).

The general conclusions drawn from investigations on the relative efficiency of the three natural agents, ocean currents, winds and birds, responsible for the introduction of plants into oceanic islands, are, that ocean currents constitute the most important agent of plant dispersal, and birds the least important, and that wind occupies an intermediate position.

Let us now apply these results to the special case of the oceanic island of Barbados. The nearest land mass to Barbados is St. Vincent, which lies to the west, and 90 miles distant. Trinidad is some 150 miles to the south-south-east with Tobago (110 miles from Barbados) intervening. The mainland of South America is distant about 200 miles at its nearest point, but the land near the mouths of the Orinoco and in Guiana, due south of Barbados, lies between 300 and 600 miles away. To the north of Barbados, the semi-circular chain of the islands of the Lesser Antilles stretches for several hundreds of miles, but Barbados is not in the line of these islands but is situated rather to the east. It is important to picture accurately the geographic position of Barbados in order to estimate the efficiency of ocean currents as a natural agent in the process of populating the Island with plants. It is necessary next to consider what are the ocean currents that wash the shores of Barbados.

(1) OCEAN CURRENTS.

An inspection of a map showing the location of the various ocean currents which occur in different parts of the world, shows that Barbados lies in the path of a branch of the South Equatorial Current, which flows across the Atlantic from the West Coast of Africa, and is divided by the great projection of the South American Continent into two branches. The branch which travels in a north-westerly direction past the mouths of the Amazon, diverts the flow of water from this river into its own direction. The combined currents then subdivide off the coast of Guiana. One branch goes out eastward parallel to the Equator, and eventually swells into the Guinea current, while the other merges with the water of the River Orinoco, and flows into the Caribbean Sea.

In its passage into the Caribbean Sea, this branch sweeps past the islands of Trinidad and Tobago, and the most southerly islands of the Antillean Chain. The shores of Barbados are thus washed by a current that has previously visited many distant lands, and it is not unreasonable to suppose that this current may bring with it much debris, including woody seeds or fruits or pieces of drift timber, which might, under favourable circumstances, serve to introduce plants into the Island. Darwin showed how certain seeds or fruits could withstand immersion in water for a considerable period of time, and still be capable of germination. He made experiments on the relative powers of resistance of seeds or fruits of many kinds of plants, and showed how it would be possible for certain of them to withstand a long ocean journey, and thus to be quite capable of introducing the species into a country far distant from their places of origin. Sea-shore plants especially figure amongst plants dispersed by ocean currents.

The flora of the beaches of Barbados includes many indigenous plants which might easily have been brought originally to Barbados by the south-easterly ocean current described above. Most of the Barbados strand plants figure in the beach flora of Trinidad and South America. Moreover, they possess woody seeds or fruits which could resist sea-water for a considerable period of time.

Seaside Lavender, Goat's foot Ipomea, seaside Grape, Manchineel, Seaside Mahoe, Scarlet Cordia, and Horse Nicker afford examples of Barbados beach plants whose fruits or seeds could quite easily be disseminated by ocean currents. We are thus safe in concluding that these plants were introduced into Barbados in the first instance by this agent of plant dispersal.*

In considering the means whereby ocean currents carry the germs of plants from one place to another, the efficiency of drift timber must not be underestimated, for Darwin's work has shown that numerous seeds may be carried lodged in the soil occurring in the tangle of roots of turn-up trees. In this way inland plants (especially those growing on the banks of rivers) might be transmitted from one country to another through the agency of ocean currents.

In order fully to appreciate the importance of the processes discussed above, it may be interesting to name actual examples which have come under the observation of inhabitants of Barbados, and which indicate beyond doubt the significance of the south-easterly ocean current as a main factor in the colonization of the Island by plants.

The first example to be quoted is the frequent occurrence on the beaches of the eastern and south-eastern shores of Barbados of the fruits of a species of South American palm (*Manicaria saccifera*, Timite). These fruits go by the name of Sea-Coconuts. They are, however, seldom known to germinate on the shores of Barbados, and the palm is never found growing amongst the beach vegetation of the Island, although plentiful in Trinidad and the Guianas. This fact, nevertheless, is not contradictory to the view that Sea-Coconuts provide evidence of the importance of the south-easterly ocean current as an agent of plant dispersal, but rather it strengthens this conclusion by proving that the fruits of this particular palm must have come from abroad, since they could not simply have dropped from any known plant already growing in Barbados.

The second example is the record of the arrival on the southern beach of Barbados, some years ago, of a piece of drift timber carrying a living specimen of a South American alligator. The stuffed remains of this animal may still be seen displayed over a store in Roebuck Street in Bridgetown.

In all probability, much drift timber has arrived at different times on the shores of Barbados from South America, having been borne by the south-easterly ocean current, and many individuals and species of plants as well as animals must have been introduced into the Island in the past by this means.

---

* See, also, the results of H. B. Guppy's recent researches, summarized in the Appendix.

(2) WINDS.

When considering the climatic factors which have been, and still are, influential in controlling the distribution of plants in Barbados, mention was made of the North-East Trade Wind which blows over the Island for the greater part of the year, and of the occasional south-easterly gales, which are experienced during the rainy season.

The North-East Trade Wind, in its passage over the North Atlantic Ocean, encounters no land between Africa and the West Indies, except the Canary Islands and the Cape Verde Islands. It is scarcely possible, therefore, that it can transport any living plant germ from Africa to the West Indies, a distance of over 2,000 miles. The south-easterly gales, on the other hand, originate in the northern regions of South America. These regions are not very remote from Barbados; they are little more than 250 miles away. The violence of these gales on occasions renders them capable of transporting light objects such as certain plant seeds, and their importance as an agent in the plant colonization must not be disregarded. Direct evidence of the ability of the south-easterly gales to introduce light objects into Barbados from land areas to the south is afforded by the not infrequent occurrence in Barbados of a South American moth (*Urania leilus*) which is only to be noticed immediately after a southerly gale has been blowing and before the Rain Bird (*Tyrannus rostratus*) has had time to bring about its quick extermination. Undoubtedly the south-easterly winds, by introducing in the first place spores of blue-green algae and nitrogen-fixing bacteria, were responsible for the preparation of the aboriginal soil of Barbados for its subsequent colonization by higher plants. Amongst the higher plants indigenous to Barbados, and represented in its present day flora, there are many species that possess seeds or fruits capable of being carried by wind.

(3) BIRDS.

Several kinds of migratory birds visit Barbados on their journeys from North America to the warmer regions of the southern continent. Many of these visitors alight at more than one of the Antillean Islands, their descent being especially frequent during squally weather, and when strong southerly gales are blowing.

Sportsmen of Barbados frequently find seeds of grasses and of certain Leguminous plants contained in the crops of birds shot in the coastal swamps. They also often notice pieces of earth adhering to the feet of these birds, and these pieces of earth may contain transported seeds.

A comparison of the flora of the Northern Islands of the Antilles with the indigenous flora of Barbados, indicates that there are certain plants common to both, but not common to Barbados and to South America. This suggests that the seeds or fruits of these plants were carried in the first instance, and are still being carried, by birds as they travel southwards from island to island. It is thus almost certain that many plants owe their presence in the numerous islands of the Caribbean area to dissemination by birds.

(4) MAN.

We come finally to a consideration of the effect on the flora of Barbados of man as an agent of plant dispersal. The great effect of man on the composition of the flora of Barbados is one of the most striking features of its present-day vegetation. By far the greater number of plants that occur in Barbados are exotic plants; plants whose introduction into the Island has been in some way or other due to man. The process of plant importation by human agency is still proceeding, and, as the regions in the Island occupied by indigenous plants decrease in size and in number, this aspect of the flora will become more and more conspicuous, until finally it will be difficult to find in Barbados any district of appreciable extent where indigenous plants grouped in natural plant community occur.

APPENDIX.

NOTES FROM "PLANTS, SEEDS AND CURRENTS IN THE WEST INDIES AND AZORES,—BEING THE RESULTS OF INVESTIGATIONS CARRIED OUT IN THOSE REGIONS BETWEEN 1906 AND 1914," BY H. B. GUPPY.

(Williams and Norgate, London, 1917).

In this recent contribution to knowledge of the mechanism of plant dispersal, the author describes the results of his researches on the transportation by ocean currents of seeds and fruits from the shores of West Africa to those of the South American continent; thence to the Caribbean Sea and the Gulf of Mexico, and finally from these Western regions to the shores of the Azores and of Europe.

CHAPTER I.

Guppy first deals with the beach-drift of the West Indian Islands (which is of fairly uniform character throughout the region), drawing distinction between local beach-drift, derived from the plants already growing within the boundaries of any one island, and foreign drift, derived from other islands across the sea. He then deals with his studies of the beach drift of the Turks Islands, (which are situated some 650 miles to the south-east of Florida, and which lie in the path of the Gulf Stream). He regards the Turks Islands drift as representing oceanic drift in transit between the western and the eastern sides of the North Atlantic Ocean.

CHAPTER II.

Next the author mentions examples of West Indian plants whose seeds or fruits are found washed up on the shores of the Azores and of Europe.

(It is interesting here to note the occurrence of the seeds of a common Barbadian and West Indian beach plant (*Guilandina bonducella*, Horse Nicker) amongst the beach drift of the Azores and of the British Isles and Northern Europe).

CHAPTER III.

In this chapter the author deals with the "drifting bottle" method of tracing the tracks of ocean currents, and of estimating the time taken by drifting bottles to complete particular voyages. He concludes that seed-drift in large amount could be carried across the South Atlantic Ocean from the West Coast of Africa to West Indian regions in a few months' time, provided these seeds could withstand a voyage of so long a duration.

CHAPTER IV.

The similarity of West Indian and West African sea-shore floras is next noted. The author states that, of the plant species found in both the tropics of the Old and the New World, 90 per cent. possess seeds or fruits which could withstand the voyage across the South Atlantic. Of the species which are confined to the tropics of the New World, less than 24 per cent., however, could

undergo the journey. These figures favour the ocean current hypothesis as the explanation of the similarity between the tropical beach floras of the Old and the New World.

[In Guppy's lists, the following familiar seashore plants of Barbados are mentioned as being common to both the Old and the New Worlds:—

Canavalia obtusifolia. (Sword Bean)
Cenchrus echinatus. (Burr Grass)
Guilandina bonducella. (Horse Nicker)
Heliotropium curassavicum. (Wild Lavender)
Ipomaea biloba (=*pes-caprae*). (Goats-foot Ipomaea)
Laguncularia racemosa. (a Mangrove swamp plant)
Portulaca oleracea. (Purslane)
Rhizophora mangle. (Mangrove)
Sesuvium portulacastrum. (Seaside Samphire)
Thespesia populnea. (Seaside Mahoe)

The following (amongst others) are stated, however, to be confined to the New World, and widely distributed throughout the West Indies.

Coccoloba uvifera. (Sea Grape)
Euphorbia buxifolia. (Seaside Spurge)
Hippomane mancinella. (Manchineel)
Tournefortia gnaphalodes. (Seaside Lavender)
all common Barbadian sea-shore plants.

CHAPTER V.

This is an account of certain facts concerning the Mangrove tree (*Rhizophora mangle*).

CHAPTER VI & CHAPTER VII.

Herein the author considers in detail the characteristics of several Turks Islands drift-plants from the standpoint of distribution.

[The following well-known plants, all of which occur in the Barbados flora, each receive individual consideration.

Spondias lutea. (Hog Plum)
Hippomane mancinella. (Manchineel)
Guilandina bonducella. (Horse Nicker)
Hymenaea courbaril. (West Indian Locust)
Mammea americana. (Mammee Apple)
Crescentia cujete. (Calabash)
Cassia fistula and *grandis;* and *Calophyllum calaba.* (*Galba*)]

CHAPTERS VIII, IX & X.

Other West Indian littoral plants are described in detail, also from the standpoint of distribution.

[They include the following plants common also in Barbados:—
Acacia farnesiana. (Sweet Briar)
Anacardium occidentale. (Cashew)
Canavalia obtusifolia. (Sword Bean)
Chrysobalanus icaco. (Fat Pork or Coco Plum)
Coccoloba uvifera. (Sea-grape)
Ipomaea biloba (=*pes caprae*). (Goat's-foot Ipomaea)
Swietenia mahagoni. (Mahogany)
Thespesia populnea. (Seaside Mahoe); and
Tournefortia gnaphalodes. (Seaside Lavender)
These are also individually described at length.]

CHAPTER XI.

The characters and geological structure of the Turks Islands are next outlined, and the conclusion is reached that they (like Barbados) are "oceanic" islands, and are formed on a basis of coral reefs.

CHAPTER XII.

The author next discusses the flora of the Turks Islands, which, he states, consists of scrub plants and sea-shore plants.

The scrub flora includes common West Indian plants, but it also includes plants which are restricted to the Bahamas as a whole.

[A similarity between the Turks Islands sea-shore flora and that of the beaches of Barbados is very noticeable from Guppy's account, but the scrub vegetation, although it includes such common Barbados rocky-land plants as *Lantana involucrata* (White Sage), *Phyllanthus epiphyllanthus* (Sickle-leaved *Spurge*), species of *Croton* and of *Pluchea,* is chiefly of a distinctive Bahamian type.]

Two-thirds of the Turks Islands littoral plants have been brought there by currents from the Antillean Islands, and, in all probability, originally came from the Old World. The remaining one-third of the littoral plants confined to the New World were doubtless introduced by birds, man, or by drifting logs. Birds were probably the agents responsible for the introduction of the scrub plants of Bahamian and Southern U.S.A. type.

CHAPTERS XIII, XIV, XV & XVI—

are concerned with the author's conclusions and views regarding the evolution and distribution of plant-forms over the earth's surface.

CHAPTERS XVII, XVIII & XIX—

deal with the geography and botany of the Azores. The Azorean flora includes woodland plants of Canarian and Madeiran resemblances, upland-moor plants of European relationships, and sea-shore plants, which show some affinities with the littoral floras of the American side of the Atlantic. The plants of the woods were probably introduced by birds (such as pigeons); those of the upland-moors by the medium of mud adhering to the feet of birds, or to their plumage; and the sea-shore plants by means of drifting logs chiefly. The Azorean coast is almost devoid of sea-beaches, being in the main rocky, hence its littoral flora is scanty.

BIBLIOGRAPHY.

Botany—General.

			s.	d.
1.	**"The Study of Plants"** (Clarendon Press, Oxford, 1915)	T. W. Woodhead	5	0
2.	**"Botany for Senior Students"** (University Press, Cambridge, 1915)	D. Thoday	5	6
3.	**"Flowering Plants and Ferns"** (University Press, Cambridge, 1908)	J. C. Willis	10	6
4.	**"Nature Teaching"** (Imp. Department of Agriculture, B.W.I., 1911) ..	F. Watts	2	0
5.	**"Plant Life"** (Home Univ. Library, Williams & Norgate, 1913) ..	J. B. Farmer	1	0
6.	**"Plant Life on Land"** (Cambridge Manuals, University Press, 1911) ..	F. O. Bower	1	0
7.	**"Systematic Botany"** (Swan Sonnenschein, 1904)	E. Warming	14	0
7a.	**"Glossary of Botanical Terms"** (Duckworth & Co.)	B. D. Jackson	10	0

Plant Ecology.

8.	**"Œcology of Plants"** (Clarendon Press, Oxford, 1909)	E. Warming	11	0
9.	**"Plant Geography"** (Clarendon Press, Oxford, 1903)	A. F. W. Schimper	40	0
10.	**"Plant Studies"** (Appleton)	J. M. Coulter	6	0
10a.	**"Types of British Vegetation"** by members of the Central Committee for the Survey and Study of British Vegetation. (University Press, Cambridge, 1911)		7	6

Agricultural Science.

11.	**"Lectures to Sugar Planters"** (Imp. Dept. of Agriculture, B.W.I., 1906)		1	0
12.	**"The Soil"** (John Murray, 1910)	A. D. Hall	5	0
13.	**"Soil Conditions and Plant Growth"** (Longmans, Green, 1913)	E. J. Russell	5	0
14.	**"Fertility of the Soil"** (Cambridge Manuals Univ: Press, 1913)	E. J. Russell	1	0
15.	**"Soils and Manures"** (University Press, Cambridge, 1915)	E. J. Russell	3	6

Special.

(dealing with the West Indies, or applicable thereto).

16.	**"History of Barbados"** (Longman, Brown, Green & Longman, 1848)	R. H. Schomburgk	(out of print)
17.	**"History of Barbados," 1657**	Ligon	do.
18.	**"Natural History of Barbados," 1750**	Hughes	do.
18a.	**"Plants, Seeds and Currents in the West Indies and Azores"** (Williams and Norgate, 1917)	H. B. Guppy	25 0
19.	**"Geology of Barbados"**, 1890 (Sold at Carnegie Library, Bridgetown)	Harrison & Jukes-Brown	2 6
20.	**"Flora of B.W.I."** (Lovell Reeves, 1864)	Grisebach	(out of print)
21.	**"Flora phanerogamique des Antilles francaises** (Annales de l'Institut colonial de Marseille, Vol. 3, 1896	R. P. Duss	—
22.	**"Flora of St. Croix and the Virgin Islands"** (Bulletin 13, U.S. National Museum, 1879)	Baron H. F. A. Egger	—
23.	**"Flora of the Dutch West Indian Islands, St. Eustatius, Saba and St. Martin"** (E. J. Brill, Leiden, 1909)	I. Boldingh	—
24.	**"New Flora of the Volcanic Island of Krakatau"** (University Press, Cambridge, 1908)	A. Ernst	4 0
24a.	**"Studies in Seeds and Fruits"** (Williams & Norgate, 1912)	H. B. Guppy	—
25.	**"At Last"** (various publishers, 1st Edition 1871, shilling Edition, Macmillan, 1910)	Charles Kingsley	1 0
26.	**"Island Life"** (Various Publishers)	A. R. Wallace	—
27.	**"Links with the past in the Plant World"** (Cambridge Manuals Univ: Press, 1911)	A. C. Seward	1 0
28.	**"Plant Life on Land"** (Cambridge Manuals Univ: Press, 1911)	F. O. Bower	1 0
29.	**"Voyage of the Beagle"** (Various Publishers, 1st Edition, 1839, "Everyman's" Edition, 1906)	Charles Darwin	1 0